Clifford Questions

Possible Alternatives to the Rolling Thunder Program

12 Apr 68	(The Case Where all Except Approximately Five Percent of the Attack and Armed Reconnaissance Sorties in North Vietnam are in Route Packages I, II, and III) (No. 7)
24 Apr 68	(The Case Where There is a Complete Cessation of Bombing in North Vietnam and Laos) (No. 9)
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28 May 68	(The Case of a Bombing Program that Includes the Mining of the Harbor Areas of Haiphong, Hon Gai, and Cam Pha) (No. 12)
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3 Jul 68	(The case in which the Rolling Thunder program that existed before 31 March is resumed, but assuming that North Vietnam attempts to infiltrate and support one, two, three, or four combat divisions into South Vietnam) (No. 11)
5 Jul 68	(The case in which the Sea Dragon Program is extended north to the Chinese Buffer Zone) (No. 5)
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7 Oct 69	Carver to Col. Robert Pursley (DOD) memo re Amendments to CIA Intelligence Memorandum [redacted] dated 28 May 1968 (amendments attached) 25X1

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DIRECTORATE OF
INTELLIGENCE

Intelligence Memorandum

POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(The case in which the Rolling Thunder Program that existed prior to 31 March is modified to include attacks against inland water control facilities.) (No. 4)

Secret

22 July 1968

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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
July 1968

INTELLIGENCE MEMORANDUM

Possible Alternatives to the Rolling Thunder Program

(The case in which the Rolling Thunder Program that existed prior to 31 March is modified to include attacks against inland water control facilities.) (No. 4)

Summary

Attacks against North Vietnam's dams and dikes, particularly the latter, could add appreciably to the adverse effects on North Vietnam of a resumption of the March 1968 Rolling Thunder Program, previously discussed in Question 10. A highly successful campaign could destroy as much as 25 percent of the annual rice crop. These water control facilities are not easily destroyed by air attacks, however, and the international reaction to the bombing of dams and dikes would be extremely unfavorable to the United States.

With one possible exception -- the 850-foot-long Dan Phuong Dam -- successful attacks against locks and dams would have little impact on North Vietnam's transport system or on Hanoi's war-supporting capabilities. A successful attack against the Dan Phuong Dam would cause serious flooding of valuable farmland southwest of Hanoi, but this dam would be extremely difficult to attack.

The most serious effects would result from a successful breaching of the elaborate system of

Note: This memorandum was produced solely by CIA. It was prepared by the Office of Economic Research and was coordinated with the Office of Current Intelligence and the Director's Special Assistant for Vietnamese Affairs.

dikes in the Red River Delta. In addition to its impact on rice crops, a successful breaching of the primary and secondary levees in the Hanoi area would produce the following short-term severe disruptions:

Most of the economic and military activity in Hanoi and its suburbs would be temporarily halted.

A number of significant military and industrial targets are located in potential flood areas. These include the Gia Lam and Bac Mai Airfields, the railroad yard and port facilities at Hanoi, and several major military barracks and storage areas and headquarters installations.

Key transport routes leading south and west from Hanoi, including Route 1A and the Hanoi-Vinh rail line, would be disrupted.

A sizable diversion of labor would be necessary for a period of weeks to repair flood damage.

The most significant results (and the most difficult to obtain) would be accomplished by a breaching of the levees during the high-water period between mid-July and mid-August. A successful attack at this time could produce losses from flooding of as much as one million tons of paddy rice. Hanoi would have to rely on external sources to replace these losses. The added import burden -- up to 2,500 tons of milled rice a day -- is well within the present estimated capabilities of the rail and road connections with Communist China.

The number of civilian casualties resulting from this campaign would be small, and, with continued aid from its allies, North Vietnam could soon adjust to the situation. Hanoi would, however, capitalize on opportunities presented by the attack to launch a heavy propaganda effort to put intense political pressure on the United States.

Inland Waterways

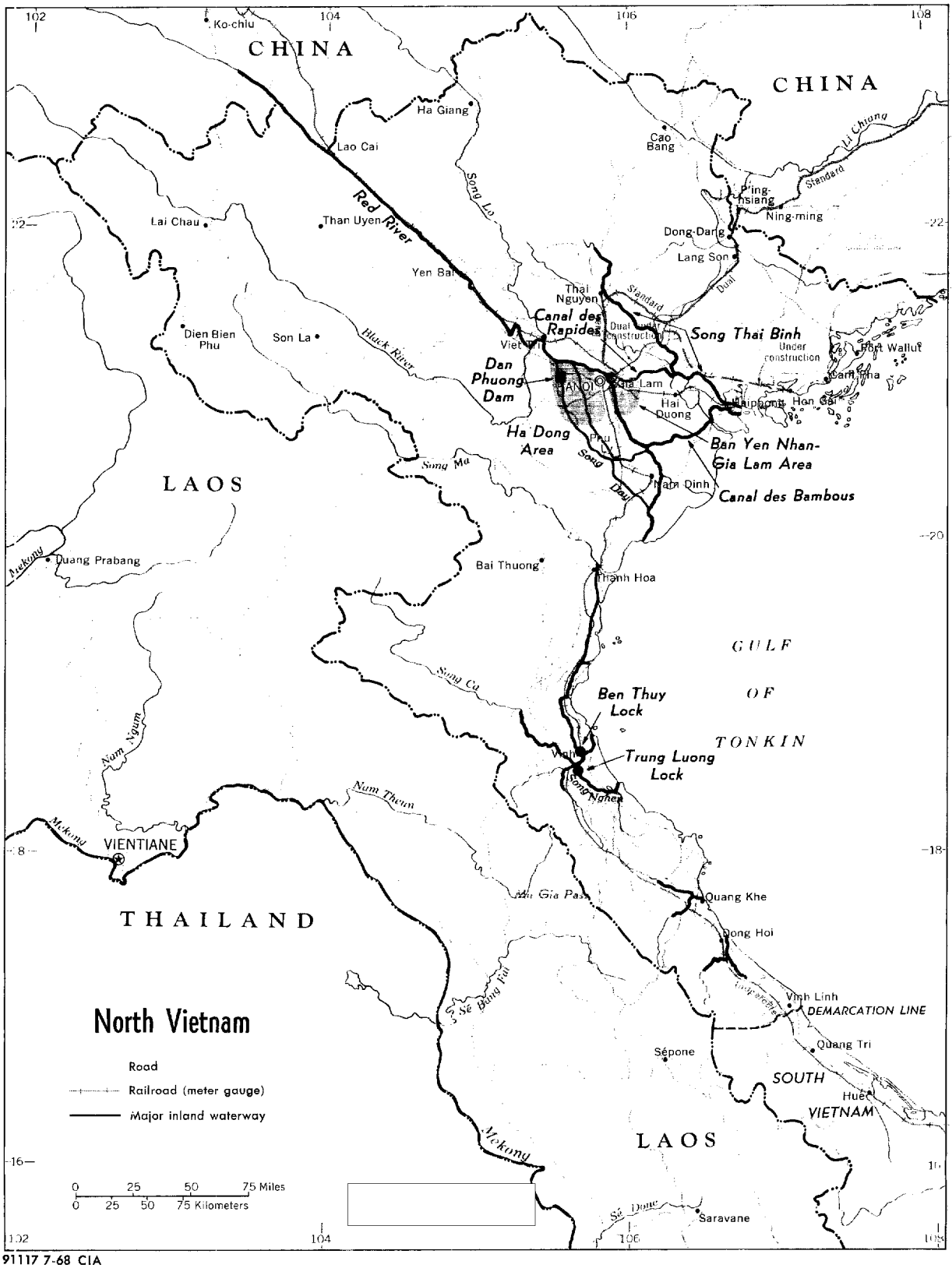
1. The Red River Delta contains the most important waterways of Vietnam -- the Red River, the Song Thai Binh River, and their two connecting waterways, the Canal des Rapides and the Canal des Bambous (see the map). These waterways connect the country's principal urban centers -- Hanoi, Haiphong, and Nam Dinh. Fertilizer, foodstuffs, petroleum, and other imports are moved from Haiphong in part by inland waterways, as is the coal mined in the Hon Gai and Cam Pha areas. Since the Rolling Thunder Program was inaugurated, an increasing number of water craft have been used to distribute POL directly from ocean tankers to dispersed storage and transshipment sites along Delta waterways and to aid in moving material from the port of Haiphong. Most of North Vietnam's farmland is in the Delta; it is dependent on irrigation during the dry months and is endangered by flooding in the wet months. Furthermore, much of North Vietnam's urban areas in the Delta are below the wet-season crests of these Delta rivers.

2. The Panhandle region of southern North Vietnam also contains navigable waterways, but they are less important than the waterways in the Delta. The most important inland waterway south of the 20th Parallel is the waterway between Thanh Hoa and Vinh. There are no through inland water routes from North Vietnam into Laos or South Vietnam. However, infiltration movements southward are facilitated by short overwater hauls and the extensive transshipment capability of the waterway system. For example, supplies shipped to Vinh via rail and highway are frequently ferried across the Song Ca River or moved in watercraft on short-distance hauls toward Mu Gia or south toward the DMZ. Other areas of watercraft activity and transshipment are at Ha Tinh, Quang Khe, and Dong Hoi. Waterways in the Panhandle also support small agricultural communities near Thanh Hoa and Vinh.

Locks

3. The Song Thai Binh River is the only major waterway in the Red River Delta that has navigation locks to control water levels and facilitate

NORTH VIETNAM: Major Inland Waterways



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transport along otherwise unnavigable stretches. These locks control water traffic to Thai Nguyen. Currently, water transport to Thai Nguyen is of little importance because bomb damage to the area's industry has sharply reduced transport requirements. A number of secondary waterways in the Delta have navigation locks, but these waterways do not handle significant amounts of traffic for urban centers.

4. In the Panhandle, a large number of small locks are found in and around Thanh Hoa and Vinh, but only a few of these locks have significance for waterway transport. The Ben Thuy Lock connects the main north-south inland waterway in this region with the Song Ca River at Vinh. The Trung Luong Lock on the Song Nghen River connects Vinh with Ha Tinh.

5. Because of their low profile and strong construction, locks are not vulnerable targets. Most of the locks consist of a single basin formed by earth slopes faced on the water side with loose stone or other masonry. Bulkheads containing steel or wood entrance gates at the end of the basins are usually made of reinforced concrete backed by earth fill. The most vulnerable parts of the locks are the gates. They can be destroyed or rendered inoperative by a small bomb, but a direct hit would probably be required. Severe damage to locks probably could be repaired within six months.

6. Successful attacks against North Vietnam's locks would have little impact on North Vietnam's transport system. Inland watercraft could be diverted to waterways not dependent on locks. Cargoes intended for water transport could be sent by the many alternative rail or highway routes that parallel the inland water network. Because of accidental bomb damage, the Ben Thuy Lock and two of the eight JCS-targeted locks are not now being used, yet water transport in the vicinity of the damaged locks seems to be unaffected.

Dams

7. Dams to control flooding and irrigation are located throughout North Vietnam, primarily in the Red River Delta. Some of these dams could be breached by a small number of hits during

periods of high water, when current velocities are greatest and the high water creates maximum pressure. The prospects for causing significant flood damage or disruption of water transport are limited. Most of the dams are small; they are made of packed earth, are less than 60 feet long, and are less than 10 feet high. The few larger dams are constructed of concrete and often have gates to permit through navigation of watercraft. Earthen dams can be repaired quickly with primitive materials and almost no construction machinery. A significant exception to North Vietnam's small and unimportant dams is the 850-foot-long Dan Phuong Dam near the junction of the Red and Song Day Rivers that protects valuable farmland southwest of Hanoi from flooding. The dam is a low, massive concrete structure, however, that would not be very susceptible to air attack.

Dikes

8. Dikes to control flooding and the course of the waterways are located along all of North Vietnam's major rivers, but they are most important and most fully developed along the Red River. The Red River dike system begins near Viet Tri, which is only 43 feet above sea level although about 100 miles inland at the northwest head of the Delta. From that point the river falls an average of 6 inches per mile to the sea. The great amount of silt brought down from the mountains and deposited along the river beds in the Red River Delta has raised the waterways above the surrounding countryside in many places and required the constant elevation of the restraining walls. In some areas, particularly around Hanoi, the height of the dikes reaches 40 feet. The primary system of dikes is backed up by a secondary system, between 4 and 22 feet high, that runs parallel to the main dikes. This secondary system is designed to localize and minimize damage if the primary dikes are breached. A tertiary system of smaller dikes has also been built to divide the rice-growing plains into compartments and to assist irrigation. These latter dikes also control the level of small streams and local waterways. In addition, the river dike system is complemented by small natural or manmade dikes along the coast which keep out brackish seawater.

9. Dikes are particularly difficult to damage by air attack. Those in the primary system can be breached only by a series of overlapping craters across the entire top of a dike. The dikes along the right bank of the Red River have a width at the top of approximately 80 feet. Moreover, the lips of the bomb craters must be sufficiently lower than the surface of the river to initiate the flow and subsequent scouring action of water rushing through the breach. A destructive force equivalent to a train of eleven 1,000-pound general-purpose bombs, which would penetrate about 10 feet in average soil and produce craters 37 feet in diameter, would probably be needed to breach the Red River dikes. To achieve a 50-percent assurance of breaching a primary levee, five of these eleven-bomb trains would be required. Furthermore, simultaneous breaching at two or more points is desirable to disperse salvage operations and to obtain maximum flood damage. Additional strikes against the secondary dike system would be necessary to preclude these supporting dikes from absorbing the effects of the breaching of the primary levees.

10. Various countermeasures are available to the North Vietnamese even if the dikes are breached. Barges could be floated into the opening and sunk, creating the beginning of a temporary coffer dam. Once the flow of water through the gap was under control, the dike could be repaired quickly. In anticipation of attacks on the water system in 1965 and 1966, the North Vietnamese apparently collected barrage materials in the Hanoi area to fill breaches in the dikes, and this material is probably still available. Defensive breaching of the dikes upstream from a bomb breach could cushion the impact of the attack and could rapidly drop the level of flood water at Hanoi by as much as six feet. In this way, less important areas would be sacrificed to save urban or key agricultural regions. Dams and other water-control facilities along the major waterways could also divert much of a threatened river's volume. For example, an estimated 10 percent of the Red River's flood volume could be diverted into the Song Day River by the dam at Dan Phuong. This is more than the Song Day can handle, but the excess would be deposited on agricultural areas which are presumably less valuable than the urban areas around the capital.

Flooding

11. The agricultural areas in North Vietnam most vulnerable to flooding are the Ha Dong area, a flat, densely populated rice-growing plain southwest of Hanoi lying between the Red River and the Song Day River, and the Gia Lam - Ban Yen Nhan area, a flat, rice-growing plain east of Hanoi, bordered by the Red River and Canal des Rapides (see the map). The Ha Dong area is a saucer-like plain only six feet above sea level at its lowest elevation. It is frequently inundated by heavy rainfall and probably could not be drained after flooding in less than a month. The Gia Lam - Ban Yen Nhan area, however, is high enough to be drained readily even during high water.

12. The principal impact of flooding resulting from air attacks against the dikes and dams would be on the rice crop -- the staple food in North Vietnam. If the dikes are breached between mid-July and mid-August, when the Red River is at its height, a substantial part of the tenth-month rice crop -- normally about two-thirds of the annual harvest -- would be completely destroyed by flooding, if the submersion of the rice plants persisted beyond two weeks. The rice plants are also vulnerable to shorter periods of submersion during mid-August after transplanting. A successful attack that managed to breach both the primary and secondary levees could cause crop losses from flooding of as much as one million tons of rice, or about 25 percent of North Vietnam's estimated 1967 production.

13. Hanoi would have to turn to outside sources to make up its rice losses. These amounts could be provided by North Vietnam's Communist allies, although they might be forced to procure offsetting amounts of grain in the Free World markets. The transport of these food supplies could be difficult, depending on the extent of damage to transport systems and the effectiveness of other interdiction programs. The losses could be replaced over a nine-month period during which the added import requirement would be a maximum of 2,500 tons of milled rice a day.* This increase in import traffic is well within the current capabilities of North Vietnam's rail and road transport connections to Communist China.

* *This calculation is based on the assumption that 700,000 tons of milled rice would be imported.*

14. Most of the industrial, commercial, and military activity in Hanoi and its suburbs would be temporarily halted until the water receded. Included in the installations that would be affected are Gia Lam Airfield, the Hanoi Port Facilities, the Hanoi Railroad Yard, the Hanoi Engineering and Machine Tool Plant, the Hanoi Thermal Powerplant, and a number of recently constructed modern industrial facilities -- the Hanoi Rubber Products Plant, the Hanoi Soap Plant, the Hanoi Machinery Plant Gia Lam, and probably the 8th March Textile Plant. Military barracks, POL and material storage areas, air defense sites, and communications facilities would also be affected. To mitigate the effects of the flooding, Hanoi would be forced to divert an undetermined but very sizable work force away from other activities, including those of a military-supporting nature, for a period of weeks until the major damage had been repaired. Contingency measures devised from operating under the annual threat of floods, however, probably would minimize serious physical damage, and it seems likely that the flooding effects would be temporary.

15. In addition to halting economic and military activity in the Hanoi area and submerging valuable farmland, the destruction of dikes and dams would disrupt transport routes. The transport routes most vulnerable to flooding include the Hanoi-Vinh rail line, Route 1A between Hanoi and Phu Ly, Route 10 southwest of Haiphong, Route 11A west of Hanoi, and Routes 6 and 212 southwest of Hanoi. Some portions of Route 5 between Hanoi and Haiphong would probably also be affected.

16. The extent of destruction caused by flooding in the Panhandle would not be as widespread as in the Delta area. Land routes would probably become blocked at least temporarily at the major river crossings, hindering the southward movement of goods.

17. The breaching of the dikes in the Hanoi area would not necessarily result in a large number of casualties. JCS pre-strike estimates of the number of casualties resulting from the actual bombing attacks do not exceed 200. This number could be less in view of the population's experience in taking shelter from air attacks. The number of

casualties resulting from flooding would also be limited because of North Vietnamese contingency planning and countermeasures and because the areas to be breached are areas in which flooding has been common; housing, for example, has been built to withstand high water levels.

Political Reactions

18. The principal effects of attacks on inland water control facilities would fall on the civilian population with only secondary effects on military targets. If the attacks successfully breached the levees and caused widespread flooding, world reaction would be highly unfavorable. The campaign would be viewed by most observers as an unconscionable escalation of the war. It would be extensively exploited in Hanoi's propaganda in order to put intense political pressure on the United States.

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DIRECTORATE OF
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Intelligence Memorandum

POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(The case in which the Sea Dragon Program is extended north to the Chinese Buffer Zone) (No. 5)

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5 July 1968

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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
5 July 1968

INTELLIGENCE MEMORANDUM

Possible Alternatives to the Rolling Thunder Program

(The case in which the Sea Dragon Program is Extended North to the Chinese Buffer Zone) (No. 5)

Summary

This memorandum analyzes the estimated effects of an extension of the Sea Dragon Program north to the Chinese Buffer Zone but under the target restrictions existing before 31 March. The analysis is based on the assumption of a campaign against North Vietnam's heartland by a force as large as three cruisers, 22 destroyers, and the recently reactivated battleship *New Jersey*, but subject to the same targeting restrictions that applied to air attacks prior to the March 1968 standdown.

An extension of the Sea Dragon Program would add little to what has already been achieved by previous air and naval attacks on North Vietnam. Only a few significant military or economic targets are within the 8 to 10 mile coastal strip that could be subject to effective naval gunfire. All of these targets could be attacked with equal or greater effectiveness by aircraft.

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The indirect effects of an expanded Sea Dragon Program might have a greater impact than the physical attack on inland targets. The major indirect effect would be the psychological impact of the visible presence of Allied warships. As an indication of Hanoi's inability to provide security, this presence might depress the morale of the North Vietnamese. Disruptions of fishing and agriculture along the coast could easily be made good by increased imports.

The nominal benefits, particularly the psychological impact, that might accrue to an extended Sea Dragon Program could be more than offset if North Vietnamese countermeasures resulted in the loss of a major Allied warship. North Vietnam's present conventional coast defense -- eight light bombers, 14 torpedo boats, and numerous coast artillery weapons -- could not deter a forcefully prosecuted Sea Dragon effort and would probably be hard pressed to sink or severely damage US ships. The risk of loss could be substantially higher if North Vietnam and its allies felt that the escalation represented by the northward extension of the Sea Dragon Program justified the introduction of Styx or Samlet surface-to-surface missiles.

I. Previous Sea Dragon Operations

Operation Sea Dragon, a US Navy surveillance and interdiction operation conducted by surface ships against the coast and offshore water traffic of North Vietnam, has been limited to the southern Panhandle of North Vietnam. The operation was first authorized against offshore watercraft between 17° (the DMZ) and 17°-30' North latitude in October 1966. In February 1967, it was expanded to include shore bombardment of military-associated targets and to extend the range of the attacks to the 20th Parallel. The operation has been restricted since March 31 to those areas of North Vietnam south of the 19th Parallel.

The Sea Dragon force has been small, with only one cruiser and four destroyers normally on station off the coast of North Vietnam. At least one of these ships has always been equipped with surface-to-air missiles. Australian and New Zealand ships have frequently participated. Spotter aircraft have usually been available for target identification and fire adjustment in good weather, and, on occasion, US aircraft have conducted coordinated attacks with Sea Dragon ships.

Sea Dragon forces have attacked watercraft, vehicles, roads, railroads, bridges, coast artillery, radar and antiaircraft sites, supply depots, barracks, and electric powerplants. The attacks have been difficult to evaluate because strikes have often been at night, in bad weather, without spotter aircraft, or against targets that have been attacked by aircraft. Secondary explosions have often been observed, however, and watercraft sightings which averaged 30 per day at the start of the program have dropped to less than four per day.

Sea Dragon forces have sustained minor ship damage and several casualties from North Vietnamese shore battery fire. Twenty Allied ships have been struck by small-caliber shells through December 1967. Five crewmen have been killed and 18 wounded. North Vietnam's small air force and navy have not attempted to attack Sea Dragon ships, probably because North Vietnamese air and naval bases have been located too far north for effective opposition.

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II. Expanded Operations

The nature of an expanded Sea Dragon Program above the 20th Parallel is not known. We assume that the restricted bombing areas existing under the March ground rules would continue. In addition, the program would be subject to the following considerations. A maximum of one battleship, three cruisers, and 22 destroyers could be sustained on station off North Vietnam without recourse to further ship reactivation. The *New Jersey* can be available for use against North Vietnam in October 1968. These ships would probably stage hit-and-run attacks rather than maintain a constant patrol in fixed locations that would invite North Vietnamese counterattacks. Sea Dragon attacks would be limited generally to targets within 17,000 yards. This limitation is determined by the offshore water depths and ship drafts, as shown in the following tabulation:

	Ship Type		
	Destroyer	Cruiser	Battleship
Main armament	5-inch	8-inch	16-inch
Range (yards)			
Maximum	18,000	29,000	42,000
Effective range a/	15,000	26,000	32,000
Ship draft (feet)	18	27	38
Average required offshore distance (yards)	10,000	12,000	15,000
Average effective range a/ inland (yards)	5,000	14,000	17,000

a. The longest range at which gunfire can be accurately controlled. Technical standards for determining this range vary with individual classes of weapons.

All of the areas capable of being struck by an expanded Sea Dragon force could also be hit by airstrikes, and in some respects there would be little

to choose between the two modes of attack. Ships would remain on station for longer periods of time, firing continuously; but air ordnance would be heavier than conventional shells, as shown in the following tabulation:

Ship	Ordnance	Explosive Weight a/ (pounds)
Destroyer	5-inch shell	7.2
Cruiser	8-inch shell	21
Battleship	16-inch shell	154
	750-pound bomb	386

a. The effectiveness of a bomb or projectile varies as the one-third power of the weight of explosive.

Naval gunfire would be delivered more accurately at short ranges and under conditions of adverse weather and visibility, but air attacks would probably be delivered with greater accuracy in good weather because of the extremely long gun ranges required by sea forces to strike targets in the north. Aircraft losses north of the 20th Parallel in the heavily protected Delta area of North Vietnam would be high, but the loss of a major warship would have a tremendous psychological impact.

III. Targets

Few military targets of any significance would be within effective gunfire under an expanded Sea Dragon Program, except for air defense sites east of Haiphong. Naval craft and bases in the Cat Ba Island area are within range of effective naval gunfire, but these targets are well protected by water-level caves. A few small barracks and storage areas could be attacked, but these facilities could be easily dispersed with little disruption to military operations. The airfield at Cat Bi, east of Haiphong, would be within range, but this field has been infrequently used. East of Haiphong, some air defense sites, including three to six known SA-2 sites, could be reached by naval gunfire. The neutralization of these sites and the relocation inland of coastal SA-2 battalions, radars, and antiaircraft artillery weapons could conceivably open a less hazardous avenue of approach for US aircraft attacking Haiphong from seaward.

Few economic targets of any significance would be within effective gun range. All rail lines, major high-ways, and bridges are well inland, beyond the effective range of the largest naval guns available to Sea Dragon forces. Even offshore watercraft would be relatively immune. Those craft using coastal routes south of Haiphong could easily be diverted to operating exclusively on the inland waterway network, well out of range of naval guns. Those operating north of Haiphong between Haiphong, Hon Gai, and Cam Pha are well protected by numerous offshore islands. There are no major industrial facilities within effective gun range and few storage sites. Twenty-two small dispersed petroleum storage tank sites with a capacity of approximately 3,000 metric tons, about 3 percent of the total storage capacity of North Vietnam, are within range, but these sites would be difficult to destroy. The tanks are dispersed within the sites, are buried in excavations, and are hardened with earth covering.

Other military and economic targets in Haiphong, Hon Gai, and Cam Pha could conceivably come under attack by Sea Dragon forces, but attacks on these ports would be highly inaccurate because of the great ranges involved. Moreover, they would risk heavy civilian casualties and damage to foreign shipping. The *New Jersey* could deliver a 16-inch projectile 42,000 yards, and the ranges to these targets from likely offshore firing sites would be between 32,000 and 42,000 yards. The average firing error at these long ranges, however, could be as great as half a mile. Maximum effective range for the *New Jersey* -- the range at which gunfire could be delivered accurately -- is only 32,000 yards. Furthermore, shore bombardment is most accurate when ships operate at firing ranges of only a few thousand yards, at slow speeds, and near familiar terrain -- conditions not likely to be met near these cities. Attempts to close the range, reduce speed, or remain in firing areas for lengthy periods of time for familiarization would greatly increase the risk of grounding or North Vietnamese countermeasures. The waters off the coast of these targets are shallow, poorly charted, and near the sites of North Vietnam's strongest coastal defenses.

IV. Indirect Effects

Fishing would be adversely affected, but even large losses would have little effect on the North Vietnamese economy. North Vietnam's major fishing centers are located north of the 20th Parallel at Mon Cay near the Chinese border, Haiphong, Do Son, and Cat Ba Island, and these centers would undoubtedly be harassed by warships conducting shore bombardment or searching for naval and logistics craft. Deep-sea fishing, however, is as yet relatively undeveloped in North Vietnam. The total annual fish catch before the bombing for all of North Vietnam was only about 200,000 tons, of which about 110,000 tons was salt water fish and the remainder fresh water fish raised in the many ponds and irrigated fields in North Vietnam. Most of the catch is intended for local consumption because of the lack of refrigeration facilities. In addition, deep sea fishing in the area north of the 20th Parallel has already been adversely affected by offshore air attacks against suspected logistics or naval craft.

Agricultural production could drop slightly as a result of the abandonment of farm land close to military, logistic, and economic targets. A small part of the cultivated area of North Vietnam could be subjected to naval bombardment north of the 20th Parallel, and some of this would be the highest yielding land in North Vietnam.

Manpower requirements to support the war could increase slightly, and fewer troops might be available to fight in the south. Extended Sea Dragon operations would probably result in the increased diversion of manpower to coastal areas to serve as spotters, coast artillery gunners, and in other coastal defense forces. The number diverted should be only a tiny fraction of the total number of workers so far diverted to war-related activities. The necessary additional manpower probably could be made up of farm workers who abandon farming operations because of the shelling. The presence of enemy warships off the coast of North Vietnam's heartland, however, would enhance North Vietnam's invasion fears and might serve to freeze additional military manpower in the north that might otherwise be sent south.

International shipping might be disrupted, but such disruption would almost certainly be minimal. Foreign-flag ships regularly transit the Tonkin Gulf to and from Haiphong, Hon Gai, and Cam Pha. Almost 400 ships visited these ports in 1967 alone, carrying 1.4 million tons of goods vital to North Vietnam's economy. In addition, four or five small North Vietnamese-flag merchant ships are believed to operate regularly between Haiphong and Chinese ports. US warships engaged in shore bombardment off these ports or in close proximity to international shipping lanes could conceivably help to discourage these ships from calling at North Vietnamese ports. Intimidation of these ships, however, would not likely enhance the effect already achieved by air attacks on Haiphong, Hon Gai, and Cam Pha and by US air and naval forces operating in the lower end of the Gulf.

Morale of the North Vietnamese population and leaders would undoubtedly be affected by the visible presence of naval warships off the densely populated areas of North Vietnam north of the 20th Parallel. The psychological impact of naval gunfire on civilian and military personnel far exceeds that of air attacks, according to survivors of both types of attacks. However, in view of the demonstrated resiliency both to air attacks and to naval bombardment south of the 20th Parallel, it is doubtful that North Vietnam's will to persist will diminish under an extended Sea Dragon Program.

V. Countermeasures

The North Vietnamese might be able to sink or severely damage one or more Allied warships participating in an expanded Sea Dragon operation with the means currently at their disposal, although such losses would probably not prevent Sea Dragon forces from carrying out their missions. A small bomber force -- eight IL-28 light bombers -- could be used against naval ships, and MIG aircraft have been noted conducting exercises over the Gulf of Tonkin. A force of about 14 modern, fast torpedo boats, including a new, Chinese-built hydrofoil boat, is based in the Haiphong - Cat Ba Island area and could operate against inshore Allied naval forces with a minimum exposure to early detection. Thirty-seven coastal defense sites, the strongest such sites in North Vietnam, are located north of the 20th Parallel, most of them guarding the sea approaches to Haiphong

on the Do Son Peninsula and off-lying islands, and nine of them make use of caves. The artillery at these sites are mostly 100-mm and 120-mm field guns with ranges around 20,000 meters, but weapons as large as 152-mm and 130-mm guns with ranges out to 27,000 meters have been identified. SA-2 battalions could also attempt attacks on Sea Dragon ships with their missiles in surface-to-surface mode -- missile range in this mode is approximately 16 nautical miles. SA-2 attacks would probably be ineffective, however, because of the small fragmentation warheads and probable accuracy limitations. Furthermore, SA-2 battalions would probably not be moved from their air defense sites to combat surface ships, because Sea Dragon attacks would almost certainly be accompanied by a resumption of air attacks. Mines and frogmen might also be employed, should US warships attempt to penetrate shallow waters at slow speeds in an attempt to improve the accuracy of their fire.

The expansion of Sea Dragon operations, and particularly the employment of the *New Jersey*, might be viewed by North Vietnam and its allies as a significant escalation of the war and might serve to justify the introduction of surface-to-surface missiles and other new weapons systems. Both the Samlet and Styx anti-ship missiles could be deployed in North Vietnam. The Samlet can carry a one-ton warhead to a fuel-limited range of perhaps 70 nautical miles, and the Styx can carry a warhead weighing more than 800 pounds to about 25 nautical miles. The operational range of both missiles, however, is believed to be limited to the radar horizon of the launch unit. Either missile could be fired from ashore, but, because most of North Vietnam's coast is very low, effective ranges might not exceed the 10 to 15 nautical mile range of conventional coastal artillery. Styx in a ship-to-ship role mounted on North Vietnamese torpedo boats would provide a more serious threat.

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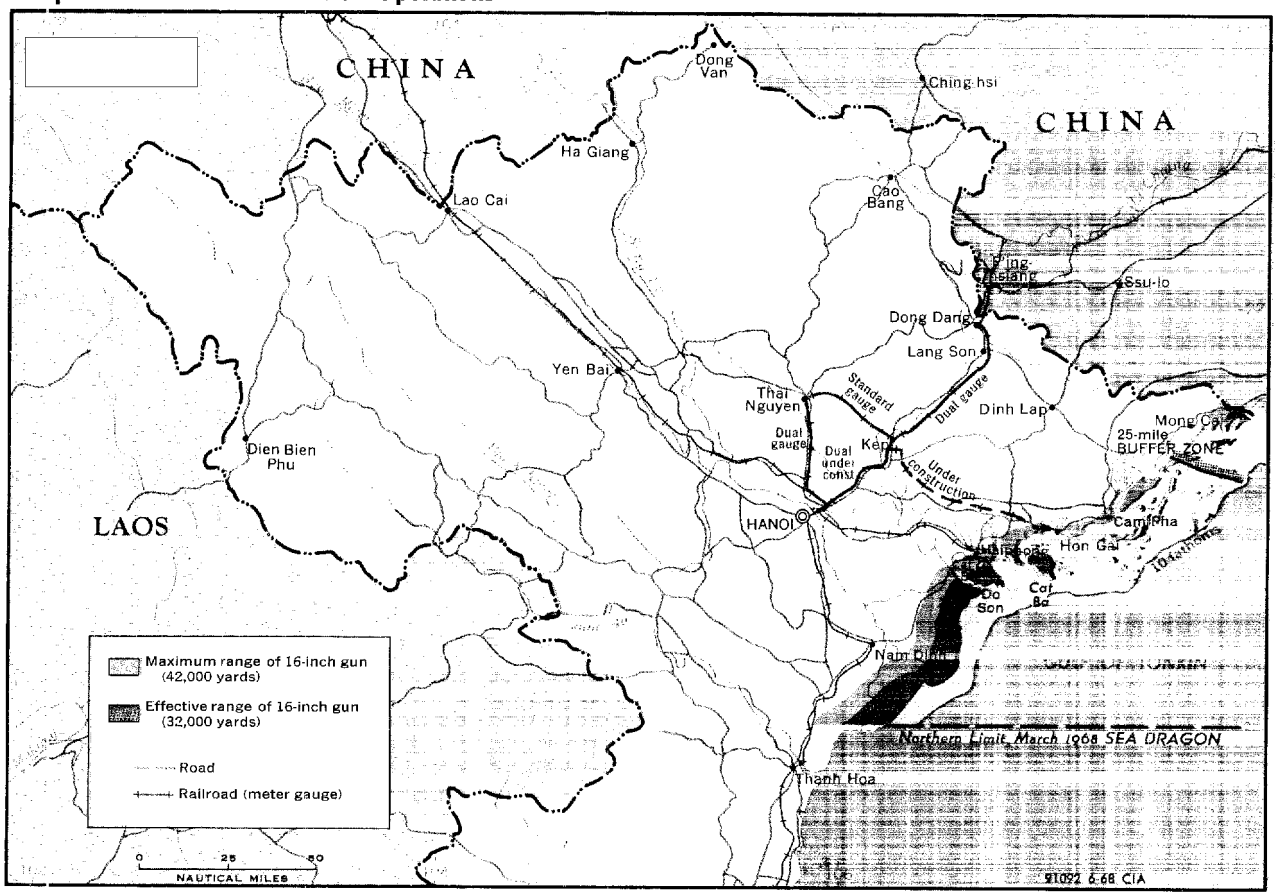
Proposed Area of SEA DRAGON Operations



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POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(The case in which the Rolling Thunder program that existed before 31 March is resumed, but assuming that North Vietnam attempts to infiltrate and support one, two, three, or four combat divisions into South Vietnam.) (No. 11)

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3 July 1968

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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
3 July 1968

INTELLIGENCE MEMORANDUM

Possible Alternatives to the Rolling Thunder Program

(The case in which the Rolling Thunder program that existed before 31 March is resumed, but assuming that North Vietnam attempts to infiltrate and support one, two, three, or four more combat divisions into South Vietnam.) (No. 11)

Summary

The deployment of an additional four divisions from North to South Vietnam would not place a major burden on the Vietnamese logistical system. The increase in the requirement for supplies from North Vietnam would be an estimated 30 tons a day. If the four divisions were deployed in areas where other sources could be tapped for food supplies, the added logistics requirements to be provided by North Vietnam could be as little as 7 tons a day.

The logistics requirement resulting from the new deployments would not place a major strain on the Vietnamese logistical system, although the movement would be more complicated and costly. The movement of 30 tons a day would be only slightly more than 10 percent of the estimated average daily levels of traffic moved to the Laotian Panhandle during the first three months of 1968. This high level of resupply through North Vietnam and Laos has not been seriously impeded by bombing in the past,

Note: This memorandum was produced solely by CIA. It was prepared by the Office of Economic Research and was coordinated with the Office of Current Intelligence and the Director's Special Assistant for Vietnamese Affairs.

including the concentrated level of attack since 31 March. The continued expansion and improvement of the transport nets in North Vietnam and Laos will provide the Communists with an even further cushion against the effects of an attack.

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Logistical Requirements

Logistical requirements from out-of-country sources for the Communist forces in South Vietnam have never been large. Viet Cong and North Vietnamese forces currently in South Vietnam require about 300 tons of logistical support daily, of which only about 90 tons -- 30 percent -- must come from external sources.

Augmenting the enemy forces in South Vietnam by an additional four divisions would increase total enemy logistical requirements by about 60 tons a day, 30 tons of which would have to come from external sources as shown in the table.

Estimated Daily Logistical Requirements
for Viet Cong and North Vietnamese
Regular and Administrative Support Troops
in South Vietnam

Short Tons per Day

Class of Supply	Current Requirements		Increment of Four Additional Divisions	
	Total	External	Total	External
I (food)	236.0	60.0	46.6	23.8
II and IV (clothing and equipment)	39.3	11.8	8.2	2.7
III (POL)	Negl.	Negl.	Negl.	Negl.
V (Ammunition)	21.6	20.6	4.6	4.1
Total	*296.9*	*92.4*	*59.4*	*30.6*

This estimate assumes that the four divisions would (1) be deployed in the I Corps area, (2) be able to obtain only one-half of their food requirements in-country and rely on North Vietnam for the remainder, and (3) engage in a high rate of combat -- one day out of fifteen. If the forces were deployed to the II Corps area, one-half of the food requirements would probably still have to come from external sources, but they could be supplied with most of these requirements from Cambodia rather than North Vietnam. If the forces were deployed in the III or IV Corps area, their external requirement could

be much less. In some areas, their food requirement could be satisfied completely from in-country sources. Under these circumstances the supplies to be provided by North Vietnam would be limited. They would include small amounts of clothing, weapons, and ammunition totaling only about 7 tons a day.

Route Capacities

Transport capacities in Laos and North Vietnam are already in excess of the traffic flow required to sustain an augmented Communist force in South Vietnam.* Routes constructed during the past year and construction currently under way will provide the Communists with even more capacity to move supplies by truck into Laos, and from Laos into at least four major areas of South Vietnam located between the Khe Sanh area and the tri-border area. When a third major access road into Laos is completed later this year, the throughput truck capacity from North Vietnam via Laos into South Vietnam will be about 1,000 tons a day during the dry season and 200 tons a day in the rainy season. The only restricting sector in this pipeline will be Route 92/96 in the southern part of the Panhandle, which limits the movement to the tri-border area to about 200 tons a day in the dry season and 50 tons a day during the wet season.

Air Attacks

Air attacks over Laos and North Vietnam have increased the cost and complicated the movement of supplies; however, even with increased intensity, they are not likely to reduce the flow below that needed to maintain an augmented enemy force in South Vietnam. A record volume of traffic -- 240 tons per day -- moved into the Laotian Panhandle during the first quarter of 1968 in the face of heavy air attacks. Even if the unusually high reported loss rate of trucks and supplies in the first quarter of this year is accurate and is sustained, losses could be made good by imports from the USSR, China, and Eastern Europe. Transport routes have considerable

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excess capacity, and, even with increased bomb damage, the rudimentary transport system is easily repaired and the network could support increased traffic flows. Furthermore, the present repair force could be augmented by additional local labor or Chinese construction troops.

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Top Secret

[redacted]

DIRECTORATE OF
INTELLIGENCE

Intelligence Memorandum

POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(ALTERNATIVES 1, 2, AND 3)

25X1 [redacted]

Top Secret

[redacted] 25X1

June 1968

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POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(The case in which armed reconnaissance attacks are permitted against lines of communication and all fixed targets in North Vietnam except those targets previously unauthorized which are within 3 and 1.5 nautical miles of the centers of Hanoi and Haiphong, respectively). (No. 1)

(The case in which existing Rolling Thunder ground rules are modified to permit coastal and reconnaissance attacks against positively identified North Vietnamese attack craft and logistics craft outside of 3 nautical miles of the coast or coastal islands of North Vietnam). (No. 2)

(The case in which the Rolling Thunder program of March 1968 is modified to include attacks against military targets in populated areas with greater likelihood of higher civilian casualties and collateral damage). (No. 3)

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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
June 1968

INTELLIGENCE MEMORANDUM

Possible Alternatives to the Rolling Thunder Program

The cases where the Rolling Thunder Program is reinstituted under March 1968 ground rules, modified as follows:

Reduction of the restricted bombing areas around Hanoi and Haiphong (No. 1)

Authorization of strikes against North Vietnamese attack and logistics craft outside the 3-mile limit (No. 2)

Authorization of strikes against military targets in populated areas (No. 3)

Summary

This memorandum examines the effects of a resumption of the Rolling Thunder Program under March 1968 ground rules, modified to permit strikes against previously unauthorized targets:

(a) all fixed targets except those within 3 and 1.5 nautical miles of the centers of Hanoi and Haiphong, respectively; or

(b) North Vietnamese attack and logistics craft outside the 3-mile limit; or

(c) any military target regardless of its location in populated areas.

Note: This memorandum was produced solely by CIA. It was prepared by the Office of Economic Research and was coordinated with the Office of Current Intelligence and the Director's Special Assistant for Vietnamese Affairs.

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The effects of any of these alternative programs would not differ markedly from those achieved by a resumption of full-scale bombing under the March 1968 ground rules.* Although alternatives 1 and 3, particularly, would add to the cost of North Vietnam's continued support of the war, their effects would in all likelihood not be sufficient to alter the course of the war. Alternative 2 would present such few additional targets that it would have little, if any, impact on the war.

Under alternative 1 only one of 26 previously unstruck targets in the Haiphong area and 20 of 49 unstruck targets in the Hanoi area would be open to attack. Few of these are of prime importance to North Vietnam's war sustaining capabilities. Alternative 3 would expose a large number of significant targets to attack, including the port facilities at Haiphong and other major transport and industrial targets. The key military command facilities that could be attacked are believed to be in hardened sites. Attacks against barracks areas would have little disruptive effect, because the dispersal of large elements of the population means that adequate housing should be available.

The major effects of the loosening of the March 1968 restrictions on the bombing program would be as follows:

1. The initial strikes against storage areas in Hanoi and Haiphong might result in the destruction of 90,000 tons of supplies, or as much as 5 percent of one year's seaborne imports at present levels. After these initial strikes, however, these facilities would be dispersed and later strikes would be much less successful.

2. Transportation problems would be increased. The flow of imports through Haiphong would become more costly and time consuming. The loss of important repair facilities, particularly for railroad rolling stock, would create localized transportation problems. The heretofore largely undamaged machine building industry that contributes to the

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maintenance of transport equipment could be disrupted. The flow of men and supplies to the south, however, would be maintained. Supplies moving into South Vietnam were only a small fraction -- 2 percent -- of daily imports in 1967. The burden of any shortfall in imports would be carried by the civilian population.

3. Attacks against previously unstruck targets in urban areas would cause heavy collateral damage to civilian structures and inflict an estimated 1,000 to 3,000 civilian casualties.

4. The morale of the North Vietnamese people and leaders might deteriorate in the long run. No accurate measure can be made, however, of the amount of pressure that the regime can withstand or the price it is willing to pay before withdrawing support of the war in the South.

5. The attacks would be carried out at a high cost to US forces. Loss rates for attacks in the Hanoi and Haiphong areas during April 1967 through March 1968 were almost seven times as high as for operations over all of North Vietnam. In addition, large numbers of US personnel being held prisoner in compounds within urban areas would also be endangered.

6. The attacks against Hanoi and Haiphong would almost certainly cause the North Vietnamese to break off the Paris talks, unless the total war situation and the status of negotiations led Hanoi to believe that it was attaining success in undermining the Saigon government. Whatever the circumstances of the attacks, Hanoi would mount a vigorous propaganda campaign charging the United States with terror attacks against defenseless civilians. Despite what might be viewed as a justifiable action in the United States, a substantial segment of world opinion would

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probably echo these charges or, at a minimum, be critical of the United States for escalating the bombing even beyond the original limits of the Rolling Thunder Program.

7. Extension of the attacks to include targets along the Chinese border would increase the chance of violation of Chinese air space and make US aircraft subject to attack by Communist Chinese aircraft and air defenses. The targets in the buffer zone are almost exclusively transportation targets. Their neutralization would be short-lived and would have only a minor impact on reducing the flow of imports.

The case in which armed reconnaissance attacks are permitted against lines of communication and all fixed targets previously unauthorized which are within 3 and 1.5 nautical miles of the centers of Hanoi and Haiphong, respectively. (No. 1)

1. Prior to the 31 March restrictions in the bombing of North Vietnam, the Rolling Thunder Program had strict ground rules controlling air attacks within 10 and 4 miles of Hanoi and Haiphong, respectively, and along the Chinese border, and imposed lesser controls over attacks within 30 miles of the center of Hanoi and within 10 miles of the center of Haiphong.* This section examines the effects of modifying -- in the event full-scale bombing is resumed -- the Rolling Thunder Program to permit armed reconnaissance attacks against all targets in North Vietnam except targets previously unauthorized that are within 3 and 1.5 nautical miles of Hanoi and Haiphong, respectively.

Airstrikes in the Reduced Hanoi Prohibited Zones

2. If the prohibited zone around Hanoi were reduced from a 10- to a 3-nautical-mile radius, 20 unstruck targets on the CINCPAC Rolling Thunder Target List (RTTL) in the Hanoi area would be subject to armed reconnaissance attacks. These 20 unstruck targets include the minor Van Dien and Phu Thi railroad sidings, three storage and supply depots, six dispersed POL sites, five barracks, a military training school, the transmitter and receiver facilities of the Hanoi international radio station, and the Hanoi chemical fertilizer plant (see Table 1). In addition, 18 previously struck targets in the RTTL, including the railroad/highway bridge and bypasses over the Canal des Rapides and the Yen Vien railroad yard would lie between the existing 10- and the proposed 3-mile prohibited zones and could be brought under more timely and frequent attack [redacted] 25X1

* *For operating constraints applying to the Rolling Thunder Program as of March 1968, see the Appendix.*

[redacted] 25X1

3. The effect of unrestricted airstrikes on targets located between the 10- and 3-mile zones around Hanoi would be only slightly greater than that achieved during the 1967 bombing campaign. Attacks on the two unstruck rail sidings would have little significance. Sustained interdiction of the Canal des Rapides bridge and bypasses and of the untargeted rail bypasses to the Doumer Bridge would increase the need for the North Vietnamese to use time-consuming and more costly alternate routes and modes of transport. There are enough bypasses and alternatives, however, for goods to continue to move through the Hanoi area. Attacks on military barracks and training facilities could be disruptive, but most of the functions of these installations could be easily relocated. The neutralization of the international radio facilities would have no significant effect on war-related communications and could quickly be offset. The Hanoi chemical fertilizer plant produces nearly 10 percent of the country's phosphate fertilizer, but the loss of the plant's output could easily be made up by increased imports. Initial strikes in the area between the 10- and 3-mile zones would probably result in heavy destruction of the transport equipment, military goods, and economic supplies now using the area as a sanctuary. After the initial attacks, however, supplies and equipment would be quickly dispersed or moved into the reduced 3-mile sanctuary area with little loss of supply capabilities.

Attacks in the Haiphong Reduced Zone

4. The reduction of the prohibited zone around Haiphong from 4 to 1.5 nautical miles would have little or no impact on North Vietnam's support of the war. Only one unstruck target on the RTTL -- a transformer station -- would be subject to unlimited attack (see Table 2). The transformer station connects the city of Haiphong into the main power network, but, if destroyed or damaged, it could be bypassed, and the city could function on local power from diesel-generating stations. Nine targets located between the existing 4-mile and the proposed 1.5-mile zones have already been struck, including the Haiphong Cat Bi Airfield, the Haiphong Highway Bridge SSE on Route 5,

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and some barracks and storage areas. Only two of these struck targets -- Cat Bi Airfield and the Haiphong Petroleum Products Storage Area -- remain as active targets on the RTTL. Unlimited attacks against these targets would have little impact beyond that achieved by previously authorized strikes [redacted] 25X1

Attacks in the Buffer Zone

5. A large number of unstruck transportation targets are in the buffer zone along the Chinese border, including the important Dong Dang railroad yard, 10 other rail targets along the Hanoi-Dong Dang line, 16 rail bridges along the Hanoi-Lao Cai line, and about 300 highway bridges throughout the zone. Attacks against these targets, however, would hinder but not seriously impair transport operations. The most serious effect would result from attacks against the Dong Dang rail bridge and the rail yard that contains some railroad car repair facilities. Although the bridge and rail yard are the most important in the China border area, they can be effectively bypassed. The unstruck bridges on the Lao Cai line are small and can be quickly repaired or bypassed. Attacks against the many highway bridges in the buffer zone would hamper transport, particularly on Routes 1A, 1B, 3, and 4, but bypasses are sufficient to assure the continuation of traffic. Initial airstrikes in the existing sanctuary area along the Chinese border would result in a substantial destruction of supplies and transport equipment, but these items would probably soon be relocated across the Chinese border and supply movements would continue unabated.

Civilian Casualties

6. Air attacks against targets close to densely populated areas would probably result in a high number of North Vietnamese civilian casualties, although effective civil defense measures and an adequate warning system would tend to minimize casualties after the first few attacks. As many as 1,000 casualties might be inflicted in attacks against previously unstruck targets, based on the estimated 2,000 civilian casualties that resulted from strikes against a larger number of similar

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targets in 1967. These casualties would probably serve only to enhance the effectiveness of North Vietnamese propaganda, rather than to weaken the morale of the populace.

US Air Losses

7. An increase in air attacks against targets within 10 and 4 miles of Hanoi and Haiphong, respectively, would most likely result in a substantial increase in US aircraft losses. Forty-two US attack aircraft were lost in combat over Hanoi and Haiphong during April 1967 through March 1968, a loss rate of 16.6 per 1,000 attack sorties, compared with an overall loss rate of only 2.4 per 1,000 attack sorties. Moreover, increases in the number of attack sorties against targets in Hanoi and Haiphong have resulted in a greater than proportionate increase in the number of combat losses.

8. Aircraft hitting targets in the Chinese buffer zone might be subject to attack by Communist Chinese aircraft or AAA, if they strayed across the border. Chinese air defenses have reacted strenuously under these circumstances in the past. The Chinese air defense system along the border with North Vietnam has been strengthened recently by the introduction of additional AAA units. A regiment of MIG-19 jet fighters has been deployed to Ning-ming, and would be capable of launching attacks against actual or alleged US air intrusions.

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The case in which existing Rolling Thunder ground rules are modified to permit coastal and reconnaissance attacks against positively identified North Vietnamese attack craft and logistics craft outside of 3 nautical miles of the coast or coastal islands of North Vietnam. (No. 2)

9. A modification of the Rolling Thunder Program as it existed in March 1968 to permit air attacks against North Vietnamese naval and logistics craft outside of 3 nautical miles of the North Vietnamese coast would have little impact on the war. Such attacks have been previously authorized throughout most of the Tonkin Gulf -- below 20° 42'N latitude -- but few lucrative targets have been available, and opening the upper reaches of the Gulf to air attack would make few new targets available.

Past Air Operations

10. The Rolling Thunder Program of March 1968 permitted armed reconnaissance air attacks against identified North Vietnamese naval and logistics craft in almost all areas of the Tonkin Gulf [redacted] 25X1 South of 20° 42'N latitude -- about 9 nautical miles south of the center of Haiphong -- all such craft could be attacked without limitation. North of this latitude to the buffer zone (25 nautical miles south of the Chinese border), armed reconnaissance was authorized against positively identified North Vietnamese craft sighted within 3 nautical miles of the coast and offshore islands of North Vietnam. North Vietnamese naval and logistics craft were free from attack only when they were outside of the 3-nautical-mile limit north of 20° 42'N (the upper reaches of the Tonkin Gulf) and then only if they did not fire on US aircraft.

11. Despite the sweeping authorization for attack, only a negligible share of the Rolling Thunder Program has been directed against watercraft in the Tonkin Gulf. Only 105 attack sorties were directed at offshore vessels in 1967, and most of these attacks were within 3 miles of the coast. These sorties delivered about 120 tons of ordnance -- 0.1 percent of the total delivered against all transportation targets in North

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Vietnam. Two PT-boats were sunk off Thanh Hoa in July 1967, and various watercraft were reported destroyed or damaged.

Potential Targets

12. Coastal junks and barges regularly move from the coal ports of Hon Gai and Cam Pha to Haiphong and further inland via coastal waterways. Coal is the principal commodity moved, but other economic goods are probably moved to the coal ports. These craft normally use the coastline for shelter and it is unlikely that they move outside of 3 nautical miles of the coast.

13. The small North Vietnamese Navy, which consists of about 40 Soviet and Chinese-built patrol boats, gunboats, torpedo boats, and subchasers, is often in the Haiphong and Hanoi areas to supplement the air defenses of the two cities. These craft seldom venture beyond Haiphong or the coastal islands east of Haiphong, however, and are rarely seen on the open seas in the areas now proposed for air attack.

14. Four to five North Vietnamese merchant coasters regularly operate between Haiphong and certain Chinese ports, usually Whampoa on the Pearl River near Canton. In the past, these coasters exported cement and coal, primarily to Hong Kong. In 1965, the last year for which such data are available, North Vietnamese vessels carried at least 56,000 tons of cargo, of which 51,000 tons were exports. These ships are believed to hug the Chinese coast, however, making air attack impractical. Even if sunk, the tonnage lost would be small, and the North Vietnamese could easily counter any disruptions by moving material via rail, road, or vessels under other than the North Vietnamese flag.

15. A few high-speed infiltration trawlers are suspected of transiting the upper Gulf en route to South Vietnam. These vessels presumably avoid running the length of the heavily patrolled North and South Vietnamese coasts by sailing through the Hainan Straits and down the eastern side of Hainan Island. Such voyages are probably infrequent; only one known attempt has been made to date in 1968 to approach the South Vietnamese coast from the direction of Hainan Island, and three of the four trawlers involved in the attempt

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were sunk. Further, the run in the Tonkin Gulf could be made almost entirely within Chinese territorial waters if necessary.

16. Major fishing centers are located at Mon Cay near the Chinese border, at Haiphong, at Do Son, and off the island of Cac Ba. Fishing boats from these centers would probably be harassed by pilots searching for naval and logistics craft in the upper Gulf. Deep-sea fishing, however, is as yet relatively undeveloped in North Vietnam. The total annual fish catch before the bombing was only about 200,000 tons, of which about 110,000 tons were salt water fish and the remainder fresh water fish raised in the many ponds and irrigated fields in North Vietnam. Seventy percent of the salt water fish catch was obtained by fishing close to shore and only 30 percent was the result of deep-sea fishing. Deep-sea fishing in the area north of 20° 42'N latitude has already been adversely affected by the Rolling Thunder Program since most fishermen have had to pass through the 3-mile unrestricted zone.

The case in which the Rolling Thunder Program of March 1968 is modified to include attacks against military targets in populated areas with greater likelihood of higher civilian casualties and collateral damage. (No. 3)

17. A renewed bombing program that brought all military targets under attack without regard to population concentrations would add to the cost of North Vietnam's continued support of the war, but these attacks would not in themselves alter the course of the war.* This alternative would open to attack 29 targets in Hanoi and 25 targets in Haiphong (see Tables 1 and 2).

Transport Targets

18. In Hanoi, attacks against transport targets in populated areas that have not been subjected to airstrikes -- including the Hanoi railroad station and classification yard, Gia Lam Airfield, Areas B and F of the Hanoi port, a small boatyard, and six vehicle repair shops -- would not be excessively disruptive. The Hanoi railroad station and classification yard contains the country's largest locomotive and rail car repair facilities. Damage to this yard could hinder rolling stock repairs and disrupt rail traffic through Hanoi. Bypasses, however, probably would provide for the continued movement of goods. The nearest alternative for rebuilding locomotives would be in Communist China, but other facilities would be available for servicing and for light repairs. Areas B and F of Hanoi port employ primitive offloading methods and are relatively immune to neutralization. Gia Lam Airfield is North Vietnam's principal airfield for international passenger service, and attacks against the airfield would likely have adverse international political repercussions.

19. In Haiphong, air attacks against unstruck port targets -- the dock area, five shipyards, a rail yard, and a cable bridge -- could seriously hinder the movement of the large volume of imports that are vital to the economy and to the maintenance of lines of

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communication.* The Haiphong dock area receives most of North Vietnam's seaborne imports. The destruction of the dock area would make it necessary to increase the use of lighters for offloading in the port area or to offload at Chinese ports and move the goods into North Vietnam by coastal craft, rail, and truck. Although less efficient, substantial amounts of seaborne imports could be unloaded by using lighters, and transport routes from China have considerable unused capacity.

20. Five unstruck shipyards in Haiphong, together with the accidentally damaged Shipyard No. 4 and a naval base, provide an important part of the country's capacity for ship repairs. Watercraft could be serviced and repaired at dispersed locations, but major repairs to seagoing ships would be disrupted by strikes against Shipyard No. 4 and the naval base.

21. Haiphong's rail yard is one of the country's primary rail facilities, containing a car repair shop, engine house, and general repair facilities. Extensive damage to the rail yards would hinder rail clearance from the port, congest port operations, and reduce rolling stock repair capabilities. However, the impact on transport capacity would be far from decisive. Port operations and clearances of cargoes were maintained in 1967 although through rail traffic to the port areas was cut for an extended period by the interdiction of the Haiphong railroad/highway bridge.

Storage Facilities

22. The denial of sanctuary for storage of goods in urban populated areas would hinder present logistical procedures and would require the initiation of alternate methods for storage and distribution. Five unstruck storage and supply depots are in the Hanoi area; in Haiphong, there are six major unstruck storage facilities including warehouses and open storage in the port. Initial attacks on storage areas could render heavy damage to accumulated imported goods. An estimated 30,000 to 40,000 tons of goods could be stored in the Hanoi port area, and the

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Haiphong port at any one time might contain as much as 50,000 tons of miscellaneous cargo including motor vehicle tires, barge sections, trucks, jeeps, construction materials, and POL drums.

Military Targets

23. Attacks against barracks areas and headquarters compounds would have little disruptive effect. Key command facilities are believed to be in hardened sites. The elimination of barracks would place an added burden on available civilian housing, but with the evacuation of large numbers of young and old from Hanoi and Haiphong, housing should be more than adequate for those air defense and military units remaining in the cities.

Targets in Industry

24. The most important unstruck industrial installations in populated areas are the machine building plants. The Hanoi machine tool engineering equipment plant, the Hanoi engineering plant, and the Hanoi machinery plant are the largest and most productive of North Vietnam's small machine building industry. Their output probably contributes significantly to the maintenance of transport equipment. Successful strikes against these plants would eliminate a large share of the country's output of diesel motors, small electric motors, generators, water pumps, and machinery spare parts, adding significantly to import requirements. Attacks against these facilities might lead to further dispersal of an already decentralized industry with the consequent inefficiencies.

25. Other unstruck industrial facilities in populated areas contribute products that support the home front or are not essential to the war effort. In Hanoi, a rubber products plant produces consumer goods and a concrete products plant produces civil defense shelters, among other products. In Haiphong, a concrete products plant, three POL tank fabrication shops, and four diesel powerplants are relatively unimportant targets.

Casualties and Collateral Damage

26. Air attacks against previously unstruck targets in densely populated areas would result in a higher number of North Vietnamese civilian casualties, although

effective civil defense measures and an adequate warning system would tend to minimize casualties after the first few attacks. The number of civilian casualties inflicted on these strikes might be as high as 3,000, based on the estimated 2,000 casualties inflicted by less intensive strikes against targets in populated areas in 1967. This level of casualties might increase the effectiveness of North Vietnamese propaganda.

27. In addition to civilian casualties, collateral damage to civilian structures would be increased. Damage to residential housing and public buildings in Hanoi and Haiphong has been light thus far, although in Nam Dinh, the third largest city in North Vietnam, collateral damage has been particularly heavy. Although casualties have been played down, collateral damage has figured prominently in Hanoi's propaganda.

28. Casualties may also be inflicted on US POW's, as a number of the targets in Hanoi and Haiphong are located close to compounds in which US flying personnel are being held prisoner. Of the more than 1,200 US personnel who have gone down with disabled aircraft over North Vietnam, about 20 percent have been reported captured and more than a third of the 550 listed as missing may have been captured. In Hanoi, there are four confirmed POW detention camps and 10 reported, but unconfirmed; in Haiphong, US POW's are reported to be in one compound. Almost all of the compounds are clustered in the built-up urban areas, and eight of those in Hanoi are near targeted facilities.

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APPENDIX

Operating Constraints Affecting the March 1968 Rolling Thunder Program

The Rolling Thunder Program at the end of March 1968 in general authorized air attacks against military-associated targets throughout North Vietnam except in the Hanoi, Haiphong, and Chinese border areas described below and against certain JCS targets -- locks, dams, and mining areas -- outside these areas. Attacks and reattacks against these proscribed areas and JCS targets had to be specifically authorized by Washington except as indicated.

1. Communist Chinese buffer zones: the area within 30 nautical miles of the Chinese border from the border of Laos eastward to 106°E, and the area within 25 nautical miles of the Chinese border from 106°E to the Gulf of Tonkin. Airstrikes were permitted against rolling stock within the zone south of the Lang Son railroad/highway bridge on the Hanoi-Dong Dang rail line.

2. Hanoi prohibited area: the area within 10 nautical miles of the center of Hanoi. Airstrikes were permitted against rolling stock on the Hanoi-Dong Dang rail line and in associated yards and spurs within the area north of the Doumer Bridge.

3. Hanoi restricted area: the area within 30 nautical miles of the center of Hanoi, excluding the Hanoi prohibited area. Armed reconnaissance could be conducted against specified lines of communication including associated ferries, fords, bypasses, and transshipment points. In addition, most other targets within the area could be attacked without specific authorization after prior notification to Washington of intention to attack.

4. Haiphong prohibited area: the area within 4 nautical miles of the center of Haiphong.

5. Haiphong restricted area: the area within 10 nautical miles of the center of Haiphong, excluding the Haiphong prohibited area. Attacks could be conducted against specified lines of communication including ferries, fords, bypasses, and transshipment points. In addition, most other targets within this area could be attacked without specific authorization after prior notification to Washington of intention to attack.

Table 1

Targets in the Hanoi
10-Nautical-Mile Prohibited Zone

Target	Map Key	JCS/BE Number
I. Targets Opened to Attack by Alternative I a/		
Phu Thi Railroad Spur	38	
Van Dien Railroad Siding	9	
Hanoi International Radio Communications Transmitter	16	
Hanoi International Radio Communications Receiver	23	
Hanoi Barracks W	1	
Hanoi Barracks NNW	24	
Hanoi Barracks WNW, Mai Dich	21	
Mai Dich Barracks 1	2	
Mai Dich Barracks 2	3	
Mai Dich Training School	4	
Hanoi Barracks/Storage Depot	6	
Hanoi Supply Depot, Xuan	34	
Hanoi Supply Depot WNW	22	
Duong Xa POL	37	
Phu Thi POL	32	
Hanoi POL, Thanh	13	

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Table 1

Targets in the Hanoi
10-Nautical-Mile Prohibited Zone
(Continued)

Target	Map Key	JCS/BE Number
Hanoi POL, Thai	18	
Phu Dong POL	36	
Co Nhue Vien POL	19	
Hanoi Fertilizer Plant	11	
II. Additional Targets Opened to Attack by Alternative III b/		
Hanoi Railroad Classification Yard and Shops		
Hanoi Vehicle Repair, Bac Mai		
Hanoi Vehicle Repair, SW		
Hanoi Vehicle Repair		
Hanoi Tank Truck Facility		
Hanoi Vehicle Maintenance S		
Hanoi Vehicle Repair S		
Gia Thuong Shipyard		
Hanoi Port Facilities (Areas B and F)		
Hanoi/Gia Lam Airfield		
Hanoi Radcom Station		
Hanoi NVN ADD Headquarters		

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Table 1

Targets in the Hanoi
10-Nautical-Mile Prohibited Zone
(Continued)

Target	Map Key	JCS/BE Number
Hanoi MND/MZ Headquarters		[redacted]
Hanoi Telephone		
Hanoi Barracks W, Yen		
Hanoi Barracks W, Tay		
Hanoi Barracks, Giap		
Hanoi Barracks, Giang		
Hanoi Barracks 3		
Hanoi Open Storage 1		
Hanoi Open Storage 2		
Hanoi Storage, Quinh		
Hanoi Storage Gia, NE		
Hanoi Warehouse		
Hanoi Machine Tool Engineering Plant		
Hanoi Rubber Products Plant		
Hanoi Engineering Plant		
Hanoi Machinery Plant, Gia Lam		
Hanoi Concrete Products Plant, Tay Ho		

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Table 1

Targets in the Hanoi
10-Nautical-Mile Prohibited Zone
(Continued)

Target	Map Key	JCS/BE Number
III. Targets Previously Destroyed or Declared Inactive		
Hanoi Railroad/Highway Bridge - Red River		[redacted] 25X5
Hanoi Railroad/Highway Bridge - Canal des Rapides (and Bypass)	35	
Yen Vien RR Classification Yard	33	
Hanoi RR Car Repair Shops, Gia Lam		
Kinh No Railroad Yard	27	
Trung Quan RR Yard	31	
Duc Noi RR Yard	29	
Van Dien Vehicle Depot Complex		
Hanoi Vehicle Maintenance	20	
Kinh No Vehicle Repair Depot	28	
Hanoi Port Facilities (Areas A, C, D, E)		
Hanoi Shipyard Thuong	7	
Thuy Phong Shipyard	26	
Ha Dong Shipyard	15	

25X1

Table 1

Targets in the Hanoi
10-Nautical-Mile Prohibited Zone
(Continued)

Target	Map Key	JCS/BE Number
Hanoi/Bac Mai Airfield		
Hanoi Radcom Receiver Station	8	
Hanoi Radio Station	17	
Ha Dong Barracks/Supply Depot	14	
Chuc Son Barracks, N	12	
Van Dien Army Supply Depot		
Hanoi Storage Area, Bac Mai		
Hanoi Storage Area, Gia Thuong	5	
Hanoi Petroleum Products Storage, Thanh Am		
Nguyen Khe Petroleum Products Storage, SE		
Hanoi POL, Duc Noi	30	
Hanoi Thermal Powerplant		
Hanoi Transformer Station		
Hanoi Concrete Products Plant	25	
Van Dien Battery Plant	10	

25X5

a. A reduction of the prohibited zone from a 10 to a 3 nautical mile radius.
b. Attacks against military targets regardless of location in populated areas.

25X1

Table 2

Targets in the Haiphong
4-Nautical-Mile Prohibited Zone

Target	Map Key	JCS/BE Number
I. Targets Opened to Attack by Alternative I a/		
Haiphong Transformer Station	1	[redacted] 25X5
II. Additional Targets Opened to Attack by Alternative III b/		
Haiphong Railroad Yard and Shops		
Haiphong Vehicle Repair		
Haiphong Cable Bridge 1		
Haiphong port:		
Haiphong Shipyard No. 3 (Area B)		
Haiphong Naval Base (Area D)		
Haiphong Docks (Area E)		
Haiphong Shipyard No. 1 (Area F)		
Haiphong Shipyard N (Area G)		
Haiphong Shipyard, Central		
Haiphong Shipyard, Le Loi		
Haiphong Air Defense Control		

a. A reduction of the prohibited zone from a 4- to a 1.5-nautical-mile radius.
b. Attacks against military targets regardless of location in populated areas.

Table 2

Targets in the Haiphong
4-Nautical-Mile Prohibited Zone
(Continued)

Target	Map Key	JCS/BE Number
Haiphong Warehouse, Port		
Haiphong Warehouse		
Haiphong Open Storage, Mall		
Haiphong Open Storage		
Haiphong Storage 5		
Haiphong Storage 2		
Haiphong Concrete Products		
Haiphong POL Tank/Drum Fabrication		
Don Nghia POL Tank Fabrication		
Haiphong Tank Fabrication		
Haiphong Diesel Power-plant E		
Haiphong Diesel Power-plant 3		
Haiphong Diesel Power-plant W		
Haiphong Diesel Power-plant 4		

25X5

25X1

Table 2

Targets in the Haiphong
4-Nautical-Mile Prohibited Zone
(Continued)

Target	Map Key	JCS/BE Number
III. Targets Previously Attacked or Declared Inactive		
Haiphong Highway Bridge, SSE		25X5
Kien An Highway Bridge		
Haiphong Railroad/ Highway Bridge		
Haiphong Highway Bridge		
Haiphong RR Yard, W		
Haiphong Port:		
Haiphong Shipyard (Area C)		
Haiphong Shipyard (Area A)		
Haiphong Shipyard, W (Area H)		
Haiphong Shipyard Thuong		
Haiphong Shipyard Loch		
Haiphong/Cat Bi Airfield	3	
Haiphong Barracks, SE, Cat Bi		
Haiphong Ammunition Depot, Kien An SW		
Haiphong Storage Area, SE		

Table 2

Targets in the Haiphong
4-Nautical-Mile Prohibited Zone
(Continued)

Target	Map Key	JCS/BE Number
Haiphong Warehouse Area, W		
Haiphong Petroleum Products Storage Area	2	
Haiphong Cement Plant		
Haiphong Thermal Power-plant, West		
Haiphong Thermal Power-plant, East		

25X5

Top Secret

DIRECTORATE OF
INTELLIGENCE

Intelligence Memorandum

POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(The Case of a Bombing Program that Includes the Mining of the Harbor Areas of Haiphong, Hon Gai, and Cam Pha.) (No. 12)

25X1

Top Secret

28 May 1968

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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
May 1968

INTELLIGENCE MEMORANDUM

Possible Alternatives to the Rolling Thunder Program

(The Case of a Bombing Program that Includes the Mining of the Harbor Areas of Haiphong, Hon Gai, and Cam Pha.) (No. 12)

Summary

This memorandum analyzes the effects of a Rolling Thunder program that is carried on without the restrictions imposed on March 31 and includes the mining of North Vietnam's principal seaports. The campaign analysed assumes a sustained and intensive effort at interdiction of the key lines of communications connecting Hanoi with Communist China as well as attacks against the Haiphong port facilities.

A mining program would serve as an effective means of interdicting North Vietnam's normal seaborne commerce. The disruption to this trade would be widespread but temporary, given Communist China's cooperation. Within a short period -- two to three months -- North Vietnam and its allies would be able to implement alternative procedures for maintaining the flow of essential economic and military imports. Shipment of goods from the USSR and Eastern Europe by overland routes would raise costs and constitute a small additional burden on Hanoi's Communist allies.

Note: This memorandum was produced solely by CIA. It was prepared by the Office of Economic Research and was coordinated with the Office of Current Intelligence and the Director's Special Assistant for Vietnamese Affairs.

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There seems, in brief, to be no way of overcoming Hanoi's ability to sustain a continuing flow of essential material support from abroad, to distribute these goods internally, and to forward them to its forces in South Vietnam, except in the unlikely event of Chinese intransigence. The existing capacities of the railroad, highway, and river connections with Communist China -- some 14,500 tons a day -- are almost three times the daily volume of North Vietnamese imports. In addition, North Vietnam can resort to small coastal craft, lightering, and even airlift, if necessary, to maintain the flow of supplies. The experience of three years of bombing makes it clear that these alternative routes cannot be interdicted to the point that traffic would be cut below present levels.

A mining-bombing program would carry with it significant liabilities. The possibility of damage, sinking, or entrapment in port of foreign shipping is high. This would present the USSR, particularly, with difficult decisions and create new risks of a Soviet-US confrontation. If the mining were effective and forced a shift to alternate overland supply routes, it would require more extensive cooperation and assistance on the part of the Chinese. This conceivably could result in strengthening Chinese political influence in Hanoi at the expense of Soviet influence. We doubt, however, that any shift would be significant in terms of influencing Hanoi's war policy, since the North Vietnamese have tended, despite considerable dependence on China in the past, to set their own strategy and make their own decisions.

A mining program would also evoke protest and critical reaction from Free World maritime states. Almost all world powers would see the program as further intensification of the war, even if the program were to follow a breakdown of the Paris negotiation.

If the negotiations were in process when the mining program was started, Hanoi would probably

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break off the talks. However, any such North Vietnamese decision would probably be based on the total war situation, including the status of the fighting in the south and the success of the talks in undermining the position of the Saigon government.

General

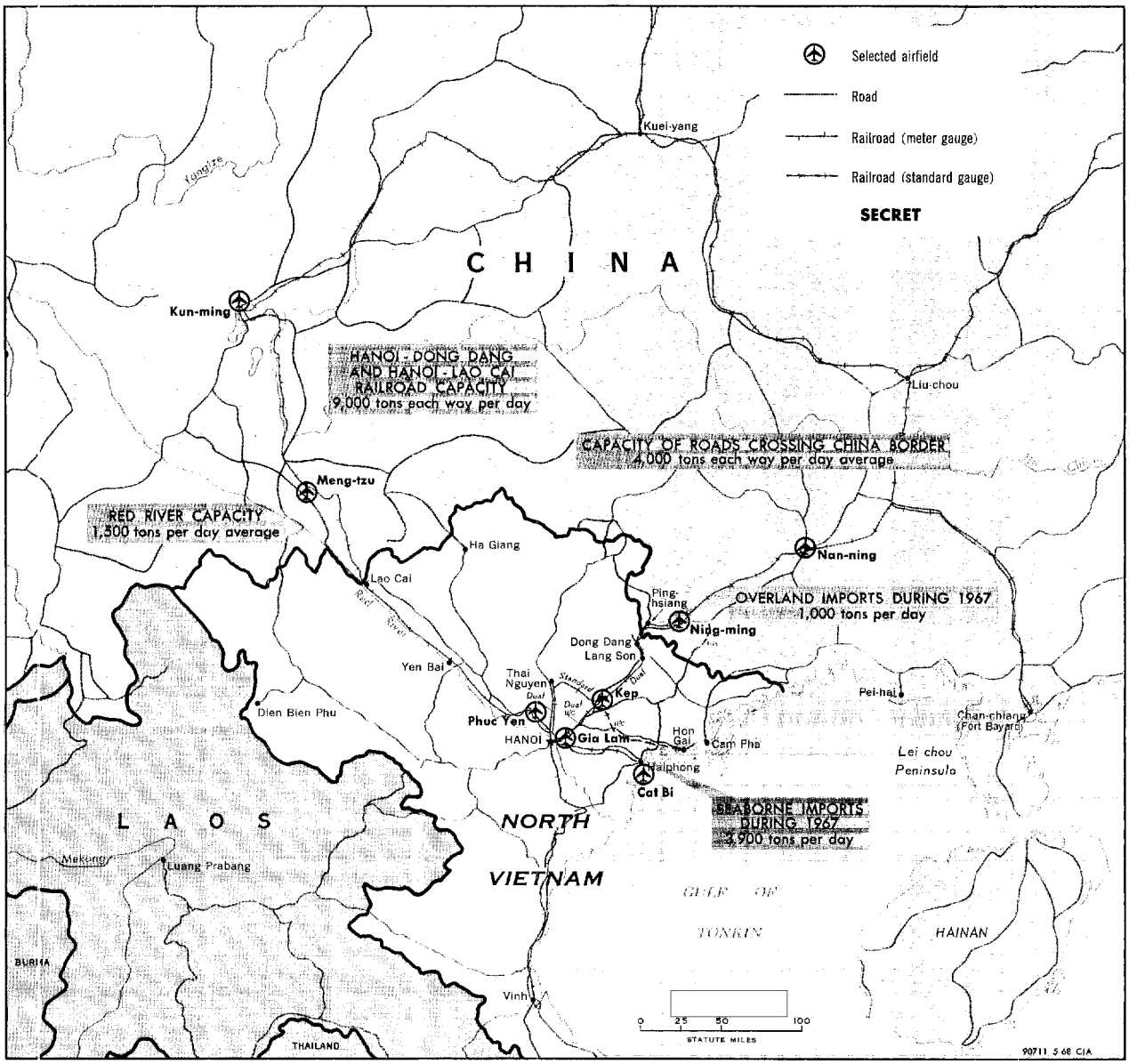
Mining the ports, coastal, and inland water ways of North Vietnam would result in the widespread disruption of normal seaborne transport. The intensity of this disruption and its duration would depend on the amount of warning time given and the extent of preparations that North Vietnam has made in anticipation of the mining. A number of foreign-flag ships might be caught in port and others en route would have to be diverted.* The North Vietnamese would have to quickly adopt alternative distribution procedures; reroute import traffic; reallocate small craft, rolling stock, and trucks; and reassign personnel.

An uncompensated loss of seaborne imports would be a serious threat to the North Vietnamese economy and war effort. Seaborne imports -- 1.4 million tons -- were about 80 percent of total imports in 1967. Imports of vehicles, machinery, generators, steel products, and petroleum have been essential to programs to repair domb damage and to maintaining the transport systems, while imports of foodstuffs and fertilizer have helped sustain the populace.

** A mining program might catch a number of foreign-flag ships in the ports, although it is possible for mines to be equipped with delayed-action fuses to provide sufficient time for foreign-flag ships to clear the port. The average number of ships at Haiphong per day during the first quarter of 1968 included 22 freighters (7 Soviet, 2 Eastern European, 7 Free World, 5 Chinese Communist, and 1 Cuban) and 1 Soviet tanker. The actual number in port on any one day during this period ranged from 12 to 26 ships. One or two ships were loading coal at both Cam Pha and Hon Gai on any given day. In addition, an average of 8 to 14 ships can be expected to be at sea and to have declared for North Vietnam. These ships would either be diverted to Chinese ports, continue to North Vietnamese waters for lightering operations, or possibly even return to home ports, depending on contingency plans.*

The North Vietnamese, however, could sustain the economy and the war effort at present levels for about two to three months solely by drawing down present reserves and maintaining present imports by rail. The high rate of imports during the past 18 months has probably permitted the accumulation of reserve supplies of petroleum, metals, construction materials, and transport equipment. Imports of foodstuffs during 1967 totaled almost 450,000 tons and have been at a higher monthly rate thus far in 1968. This level of imports exceeds the estimated crop shortfalls during the last 18 months and suggests that food reserves on hand are adequate for several months of consumption.

By the end of three months, the North Vietnamese could have taken the necessary countermeasures to the mining program by rerouting essential seaborne traffic to one or more of the many alternative transportation routes. Two rail and eight highway routes connect Hanoi with Communist China. The upper reaches of the Red River from China provide another route that can carry many kinds of imports. These land alternatives were used to less than 10 percent of their capacity during 1967 and are being used even less at present. Shallow-draft lighters could be used to unload cargo from oceangoing ships anchored in waters outside the mined areas. Large numbers of coastal ships and junks could move cargoes from ships diverted to the southern Chinese ports of Fort Bayard, Canton, or Peihai and unload in ports, over the beaches, or move into North Vietnam's network of inland waterways. An airlift from Chinese airfields to Gia Lam, which handles international traffic and has not yet been struck by air attacks, could potentially provide a means for importing a large volume of high-priority goods. Imports formerly received by sea could move by rail all the way from the USSR and Eastern Europe or they could be transshipped from South China ports without placing a noticeable strain on either the Soviet or Chinese rail systems. Two trains (of 35 freight cars each) arriving each day from China could carry the entire volume of Soviet and Eastern European seaborne goods imported by North Vietnam in 1967. For selected transportation facilities in North Vietnam and South China, see the map.



NORTH VIETNAM and SOUTH CHINA: Selected Transportation Facilities, May 1968

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All of the countermeasures to a US mining program, except for direct lightering from ships to the shore, would require the cooperation of the Chinese. If all Soviet and East European seaborne shipments were diverted to an overland route via the Trans-Siberian railroad, the Chinese would have to permit a sixfold increase over the 1967 volume of Soviet and East European traffic transiting China. Using Fort Bayard, for example, would require a willingness on the part of the Chinese to transship cargo by rail 668 kilometers from Fort Bayard to P'ing-hsiang. The Chinese would probably be reluctant to emphasize the importance of Soviet aid to North Vietnam by cooperating in this manner. However, faced with the alternative that the North Vietnamese could not continue the conflict without major infusions of Soviet and East European aid, the Chinese would probably be forced to help maintain the flow regardless of the nationality of the donors.

Levels of Import Traffic

During 1967 North Vietnamese imports reached record levels totaling almost 1.8 million tons as shown in the following tabulation:

	Metric Tons	
Economic goods	Annual	Daily
Bulk foods	447,000	
Fertilizers	147,000	
POL	256,000	
Miscellaneous	809,000	
	1,659,000	4,600
Military goods	125,000	300
Total imports	*1,784,000*	*4,900*

During the first four months of 1968 imports have been at levels 10 to 15 percent higher than in the corresponding period of 1967. Most of this increase has been in imports of foodstuffs and petroleum.

The volume of imports maintained by North Vietnam has been in excess of the current best estimates of consumption patterns and requirements. Part of the surplus may be to compensate for disruptions to production or to distribution and storage systems. On the other hand, it is likely that this high level of imports reflects an element of contingency planning by Hanoi to build up reserves and stockpiles in the event that the port of Haiphong is closed.

The importance of Haiphong is apparent in the fact that seaborne imports during 1967 averaged 3,900 tons a day, or about 80 percent of North Vietnam's total imports. Thus if the use of Haiphong were denied, North Vietnam could possibly be required to move almost five times as much cargo over its existing land transport connections with Communist China. The added burden on the land transport connections could be reduced to the extent that North Vietnam is able to cut back on its total import requirements. On the other hand, North Vietnam should be able to transfer some part of the import burden to other means of transport such as coastal shipping, lighters, and air transport.

Land Route Capacities and Import Requirements

The daily capacity of the railroad, road, and water routes from China to the Hanoi area of North Vietnam totals 14,500 tons and far exceeds the daily tonnage requirements needed even if all seaborne imports were shifted to land routes (see Table 1).

The high volume 1967 import program would exceed the capacity of the existing road and inland water systems and could conceivably exceed the interdicted capacity of the railroads. When the land transport routes are viewed as a single system, however, the combined capacity is almost three times greater than traffic requirements.

While there would be initial delays and confusion, the North Vietnamese would be able to obtain, deploy, and operate the required number of trucks, railroad rolling stock, and water craft to shift all of their seaborne imports to land lines of communication. The North Vietnamese would probably

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Table 1

Comparison of Import Requirements
to Capacities of Lines of Communication

	Tons per Day	Imports as a Percent of Capacity
Actual 1967 imports	4,900	
Capacities		
Total surface lines of communication	14,500	34
Railroads a/	9,000	54
Roads	4,000	122
Red River	1,500	327

a. These are uninterdicted capacities. Although the Hanoi-Lao Cai line is given a current capacity of 700 tons a day, its normal capacity of 3,000 tons a day is used here. It is assumed that the alternate facilities that give a capacity of 700 tons a day at the Viet Tri interdiction point are more than adequate to meet current small traffic requirements. For the purpose of this memorandum, it is assumed that if a higher traffic requirement existed, the North Vietnamese would raise capacity to whatever level was necessary. Moreover it is estimated, on the basis of their demonstrated capability, that the necessary alternate crossings could be established and in operation within three months.

receive additional logistical support from the Chinese in terms of rolling stock, engineering troops, and transport specialists. To move the entire volume of 1967 imports -- 4,900 tons a day -- by rail from P'ing-hsiang to Hanoi would require the employment of about 300 standard gauge freight cars in about seven trains arriving daily, without even using the roads or Red River to move a portion of the traffic. The roads and Red River have a combined capacity of 5,500 tons a day. This provides a cushion that is more than adequate to accommodate whatever volume of traffic cannot be moved by rail.

Water and Air Alternatives

North Vietnam can use other alternatives to maintain its import traffic and thus avoid complete reliance on its overland transport connections. These alternatives include lightering of oceangoing ships outside mined areas, the use of coastal shipping from China, and the use of air transport.

In the case of lighters and coastal craft, North Vietnam has adequate inventories to move import traffic even at the higher levels of 1967. As a practical matter the use of these water alternatives would probably be limited. The off-loading of some types of cargo -- bulky machinery and transport equipment -- would be difficult. Also in the face of air attacks and a widespread use of the MK-36 mine, it is possible that cargo losses might be too heavy to warrant sustained use of lighters or coastal shipping. They could, however, be used sufficiently to be a significant means of easing pressures on overland transport routes.

The use of air transport would probably be limited to the import of high-value or urgently needed imports. An air transport program would be almost wholly dependent on Soviet and Chinese assistance. Because the Chinese could not provide the aircraft necessary to sustain a large airlift without disrupting air transport in China, the USSR would have to furnish the aircraft to sustain such an operation. The Soviet military inventory of high-performance transport aircraft as of 1 January 1967 included about 640 AN-12's designed for short take-offs and landings on unimproved runways. About 100 AN-12's could provide an airlift between South China and North Vietnam at the 1967 import rate of 4,900 tons a day.

The Chinese would have to permit the Soviets to transit Chinese territory to a much greater extent than they have thus far and permit Soviet personnel, aircraft, and maintenance facilities on Chinese airfields. Because an airlift would not be required to move all imports, it is doubtful that the Chinese would make such concessions. Furthermore, the

Soviets themselves would probably not be willing to risk the escalation of the war which might occur if Soviet aircraft were destroyed during US air attacks on North Vietnamese airfields.

The Experience of Past Interdiction Campaigns

An air campaign aginst the northern lines of communication in circumstances when they are required to carry all of North Vietnam's imports should achieve greater interdiction of supplies than any US effort to date. Target density -- in terms of traffic volume -- would be about five times that which moved over these lines during June-August 1967, the high point of past US interdiction efforts. It is probable that the railroads alone could not bring in the 1967 volume of imports if they were kept under sustained air attack. The 1967 volume of imports would require slightly more than one-half of total rail capacity, and an intensive and sustained air interdiction program may have a good chance of reducing rail capacity by more than this amount.

However, on the basis of all the modes of transportation that are available to the North Vietnamese, an air interdiction effort against the lines of communication from the China border is not likely to be successful. Air attacks would have to overcome the same problem that has previously hampered such efforts -- the combined capacities of the routes greatly exceed the requirements for traffic. Even a highly successful air interdiction campaign against railroads could not be expected to reduce their capacity to the level necessary to impede the flow of essential economic and military goods. The capacities of roads and waterways would supply an additional cushion or guarantee that adequate capacity was available.

Results of the June-August 1967 air interdiction campaign, the heaviest of the war so far, support the contention that an interdiction effort, even against a heavier concentration of targets, will not exact a prohibitive cost from the enemy or "succeed" where earlier efforts have failed. The

heavy attacks during the June-August period damaged bridges, interdicted roads and rail yards, and forced the Vietnamese to use elaborate time-consuming and labor-consuming bypass systems that consisted of alternate semipermanent bridges, pontoon bridges, causeways, and motor truck and railroad car ferries. Nevertheless, the North Vietnamese transport system was still able to function effectively.

Strikes in August against the Hanoi-Dong Dang rail line -- the rail line most used for import traffic from China, the USSR, and East Europe -- were effective in stopping through service for a total of only ten days. It was not possible to interdict through traffic for a longer period of time mainly because each bridge attacked had one or more bypass bridges available. Photography taken throughout the period indicates that several yards were sometimes unserviceable for through rail service after they were struck but had at least one through track open for traffic within a short time.

Strikes against the three highways which generally run parallel to the Dong Dang line and can serve as alternates for the rail line -- Highway Route 1A and two other highways from Mong Cai and Cao Bang -- were probably even less effective. Observed countermeasures indicate that no significant or sustained reduction of capacity was made.

Strikes against the Hanoi-Lao Cai rail line -- the other rail line used for import traffic from China, the USSR, and Eastern Europe -- did not reduce the capacity of the line below the 700 tons achieved by the destruction of the Viet Tri bridge in 1966. The line's capacity of 700 tons was maintained by a rail car ferry at the site of the still unrepaired Viet Tri bridge. If more capacity had been required, there is every reason to believe that additional facilities would have been installed at this location to restore the through capacity of the line.

Strikes against the two highway routes that parallel the Lao Cai rail line were equally ineffective. Highway traffic around the destroyed bridge at Viet Tri was moved throughout the June-August period by

ferries, a pontoon bridge, and in part by a cable bridge. Damage to other highway bridges attacked on the two routes was not significant; structures were quickly repaired or bypassed.

Prospects for Interdiction of Alternative Routes

An air interdiction campaign against North Vietnam's lines of communication in conjunction with a mining program must allocate the total number of sorties available to a conventional mining program against oceangoing shipping; the MK-36 mining program; strikes against fixed targets such as bridges, ferries, rail lines and highways; and strikes against fleeting targets -- railroad rolling stock, trucks, and watercraft.

The essential problem is to reduce the capacity of 14,500 tons per day that is avaiable to the North Vietnamese for moving supplies south from China to a level that puts a meaningful ceiling on traffic flows. This objective requires interdiction of facilities or equipment to a much greater extent than has been achieved thus far in the air war. Three years of air war in North Vietnam have shown -- as did the Korean War -- that, although airstrikes against rail and road segments will destroy transport facilities, equipment, and supplies, they cannot successfully interdict the flow of supplies, because so much of the damage can frequently be repaired within hours.

The complexity of the interdiction effort is apparent in the multitude of targets that must be kept under attack. North Vietnam, for example, has 650 permanent bridges on the principal lines of communication that could be used to circumvent the mining of Haiphong. If all of these permanent bridges were provided with alternate crossings to the same extent as the bridges on the vital Hanoi-Dong Dang line, there could be as many as 2,000 fixed transport targets. In addition, the North Vietnam logistics target system includes large numbers of transport vehicles that must be neutralized. North Vietnam could commit to its resupply programs an estimated 120 locomotives, 2,000 to 2,300 freight cars, 11,000 motor trucks,

25X1

and more than 30,000 water craft. Only a small share of these vehicles would be required to maintain import programs at 1967 levels.

From June through August 1967 the lines of communication in North Vietnam were subjected to the heaviest scale of attack achieved to date. On the basis of an assumed 50 percent increase in the scale of the attack (from an average of 285 to 425 sorties a day) and damage effects similar to those achieved to date, the prospects for an escalated interdiction campaign can be estimated. The results, summarized in Table 2, show clearly that even this heightened campaign offers little promise of reducing the flow of supplies significantly.

If this campaign were flown exclusively against fixed targets, hits against facilities such as bridges or alternate crossings would range from 24 to 47 a day, depending on the ordnance mix. If the attack were flown solely against fleeting targets, it is estimated that 75 vehicles a day would be effectively destroyed. In either case, or in any combination of attacks, it is probable that weather and operational problems would make it impossible to maintain this extent of damage on a daily basis.

The frequency with which bridges and bypasses could be kept under attack would obviously be less than the time required to offset damage effects. On the basis of past effectiveness of North Vietnamese countermeasures, an interval as short as two to four days would be more than enough to repair the bomb damage done to the majority of the specific facilities or to institute substitute means of continuing traffic.

In 1967, only the attacks against the key Doumer, Canal des Rapides and Haiphong bridges required a repair time in excess of 30 days. In all three of these cases, however, the North Vietnamese have built numerous high-capacity bypasses that have been more than adequate to keep traffic moving. Numerous other examples exist to show that even heavily damaged bridges were repaird within a few days of being hit. When two 53-foot spans were dropped at the Bac Giang Railroad/Highway Bridge on

30 April 1967, the Vietnamese and Chinese had it repaired and serviceable one day later. The isolated and intermittent cuts that can be expected along the various lines of communication would not be sufficient to seriously impede the flow of supplies.

The maximum attack against fleeting targets could be expected to deplete the inventory of freight cars and motor trucks* committed to import operations within four or five months. This prospect is lessened by several factors:

1. Inventories of transport equipment could be maintained through increased imports. The Chinese inventory of standard gauge railroad cars would be available to move essential supplies from China to the Hanoi area. Imports of trucks would have to increase substantially, but total imports would not have to exceed 1,800 per month.**

2. It is doubtful that previous kill ratios -- heavily weighted by operations in the panhandle of North Vietnam where antiaircraft fire is much less than over Route Package VI -- can be maintained.

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* *It is assumed that, because of priority uses in North Vietnam and Laos, only one-half of the total inventory of motor trucks, or some 5,500 vehicles, could be allocated to the import operation.*

** *This would not be an impossible drain on Communist truck production. During the Korean War, the enemy was estimated to have had 8,500 vehicles in operation. Some 48,000 were destroyed and damaged during an eleven-month perid by the US Air Force alone. The operable inventory of vehicles, therefore, was replaced or rebuilt more than five and one-half times during this period if the Air Force claims were accurate. To maintain the operable inventory of 8,500 during the eleven-month period, about 4,400 vehicles would have had to be imported or restored each month, more than double the monthly vehicle kills of 1,800 estimated for North Vietnam under the assumed escalation of the airstrikes.*

3. Furthermore, the experience of the air war has shown that, because of bad weather, intensive attacks against lines of communication cannot be maintained over long periods of time. For example, during July 1967 a daily average of 120 attack sorties were directed against targets in Route Package VI. In December 1967, bad weather reduced this average to only 27 attack sorties.

Both of the damage effects discussed in this section represent maximum results from a concentration of the attack on either fixed facilities or fleeting targets. The effects of a mixed target program would be between the extremes discussed here. Whatever the mix of targets, it is apparent, however, that the attacks contemplated in this section -- up to 50 percent greater than those accomplished so far against the lines of communication -- would create widespread problems for the North Vietnamese and there would be a much higher rate of destruction of transport equipment and cargoes than has been achieved thus far during the air war. It is probable that for certain periods of time -- days or even weeks -- the North Vietnamese could not move the total volume of 1967 imports, 4,900 tons a day. Over the longer pull, it seems certain, however, that by using all facilities available to them, and by receiving additional aid, the total volume of military and economic goods necessary to continuing the war could be maintained.

Targets in the Haiphong Port Area

There are a number of targets in the Haiphong port complex that could be included in a complete interdiction campaign. These targets include:

JCS Number	BE Number	Facility
		Haiphong Docks (Area E)
		Haiphong Naval Base (Area D)
		Haiphong Shipyard 3 (Area B)
		Haiphong Shipyard 1 (Area F)
		Haiphong Shipyard North (Area G)
		Haiphong Railroad Yard Shops

25X5

25X1

JCS Number	BE Number	Facility
		Haiphong Warehouse Area, Port
		Haiphong Warehouse Area
		Haiphong Shipyard Vinh
		Don Nghia POL Tank Fabrication
		Haiphong Shipyard Central
		Haiphong Air Defense Center
		Haiphong Open Storage Mall
		Haiphong Storage 5
		Haiphong Open Storage
		Haiphong Storage 2

25X5

The attacks would compound distribution and storage problems and deprive Hanoi of a valuable sanctuary, and initial attacks might destroy large quantities of stockpiled supplies. Many of these targets, however, would lose their lucrative character after the first attacks. The open storage and warehouse areas, particularly, would not be used after attacks against this area. Stockpiles would be moved to dispersed storage areas, and little new materiel would be entering Haiphong during a mining campaign.

The effects of successful attacks on port and shipyard facilities might have some immediate significance, but these effects would be short-lived for several reasons. The shipyards taken under attack contribute a relatively small percent of total North Vietnamese shipbuilding and ship repairs capability. These yards are engaged principally in building and repair of small craft and barges. This type of activity is easily transferred to other locations, and the production that is lost can be replaced by new imports or transfers of Chinese small craft and barges. More to the point, a complete cessation or sharp decrease in seagoing commerce resulting from a mining program would mean that these facilities would fall into disuse as imports are transferred to alternative routes. The use of such alternatives as lightering and coastal shipping generally would not require the use of Haiphong port facilities.

All of the targets listed are located within a radius of 1.5 miles from the center of Haiphong. They are located in formerly prohibited zones that

25X1

are built up and heavily populated. It would be almost impossible for air operations to avoid spilling over into areas where civilian casualties would be at high rates.

Finally, these targets are located in one of the most heavily defended areas of North Vietnam. The experience of previous campaigns shows that attacks against targets in the immediate areas of Hanoi and Haiphong have resulted in loss rates for US aircraft from seven to eight times greater than the rate for operations over all of North Vietnam.

25X1

Table 2

Hypothetical Escalated Attacks Against
the Northern LOC's in North Vietnam

Scale and Weight of Attack		Targets	
	Average Sorties per Day		Number
June-August 1967	285 a/	Fixed targets	
Assumed escalation	425 b/	Permanent railroad bridges	141
Allocation of sorties sorties		Permanent highway bridges	500 +
		Total permanent bridges	*650*
MK-36 program	40 c/		
Other targets	385	Total potential fixed transport targets	2,000 d/
Estimated Effects		Mobile targets	
	Total per Day	Locomotives	120
Hits on fixed facilities	24 to 47 e/	Freight cars	2,300
		Motor trucks	11,000
Mobile targets destroyed	76 f/	Junks, sampans, and barges	30,000 +

a. Average against all lines of communication (rail and highway) in North Vietnam.
b. An increase of about 50 percent above the June-August 1967 rate concentrated against northern lines of communication only.
c. The MK-36 program calls for 13,000 weapons to be delivered per month by mid-1968, which would require an average of 40 sorties per day. About 385 sorties would therefore be available for delivering standard ordnance -- about 1.7 tons per sortie -- the rate at which it was dropped during attacks on the lines of communication during June-August 1967. For the purpose of this illustration, it is assumed that most of the MK-36's will have to be used to attempt to halt lightering operations.

25X1

Table 2

Hypothetical Escalated Attacks Against
the Northern LOC's in North Vietnam
(Continued)

d. Total permanent bridges plus improvised alternate facilities extrapolated at the rate that they exist on Yen Vien - Dong Dang line.
e. A case study of the attack on 48 JCS-targeted bridges in North Vietnam during the period February 1965 through December 1966 reveals that on the average one hit was scored for every 47 bombs dropped. Using this experience, 550 tons of conventional ordnance has a good probability of providing 47 hits with 500 pound bombs, or one-half that number with 1,000 pound bombs. A hit was defined as causing the collapse of one or more spans or causing structual damage to piers or abutments.
f. During 1967, it is estimated that there was one effective loss to a vehicle (locomotive, freight car, motor truck, or watercraft) per 5.1 armed reconnaissance sorties flown. Therefore, 385 sorties per day would destroy about 75 vehicles.

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DIRECTORATE OF
INTELLIGENCE

Intelligence Memorandum

POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(The case where the Rolling Thunder Program is reinstituted under the March 1968 ground rules limiting attacks within 10 and 4 miles of the centers of Hanoi and Haiphong, respectively, and within the Chinese Buffer Zone.) (No. 10)

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22 MAY 1968

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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
22 May 1968

INTELLIGENCE MEMORANDUM

Possible Alternatives to the Rolling Thunder Program

(The case where the Rolling Thunder program is reinstituted under the March 1968 ground rules limiting attacks within 10 and 4 miles of the centers of Hanoi and Haiphong, respectively, and within the Chinese Buffer Zone.) (No. 10)

Summary

This memorandum examines the effects of a resumption of the Rolling Thunder program under the March 1968 ground rules. These rules permitted all of North Vietnam to be taken under attack except for targets within restricted bombing areas around Hanoi and Haiphong and within the Chinese Buffer Zone.

A return to the Rolling Thunder program as it existed before 31 March, particularly if undertaken during the second and third quarters of the year, when good weather predominates, could have the following major effects in the short-run:

1. Restoration of key industrial facilities, already accomplished or in process, would be quickly neutralized. Consequently, electric power output would again decline to 20 percent of national capacity, and cement and fertilizer production would cease.

Note: This memorandum was produced solely by CIA. It was prepared by the Office of Economic Research and was coordinated with the Office of Current Intelligence and the Director's Special Assistant for Vietnamese Affairs.

2. Coal exports, which in April 1968 had been brought up to 60 percent of pre-attack levels, would again decline, and prospects for exports of pig iron, cement, and apatite would be indefinitely postponed.

3. The restoration of through traffic on the principal rail and highway systems, which is being accomplished by the repair of key bridges, would be disrupted. The restored bridges and rail lines, enlarged truck parks, and open-storage stockpiles would constitute lucrative targets in the logistic supply system. An estimated 20,000 full-time North Vietnamese workers and 40,000 Chinese construction troops have been devoted to the restoration of this system since the partial cessation of bombing on 1 April.

4. It would again be possible to take under attack the major airfields in the north holding jet fighter aircraft. The in-country air Order of Battle now consists of 13 MIG 21's, 12 MIG 17's, and 4 IL-28 bombers.

5. There would be an immediate decline in the morale of the North Vietnamese population, since they would again be faced with the hardships and stress associated with the bombings. There would be increased local temporary shortages of food, more widespread shortages of consumer goods, and renewed requirements for extra work in repairs, civil defense, and other activities. Casualties, which amounted to approximately 36,000 killed and wounded in 1967 under the previous Rolling Thunder campaign, would again make a significant impact.

6. Since the resumption of a full-scale attack on the north would probably follow as a consequence of the complete impasse of peace negotiations and a continuation of a high

level of infiltration of North Vietnamese forces into South Vietnam, presumably the Hanoi regime would have taken into account the consequences of its intransigence.

7. Although a large segment of world opinion would be critical of the United States for resuming the general bombing program, the extent of this criticism would depend on the circumstances under which the bombing was resumed. These criticisms would be particularly vocal if the bombings were expanded while the Paris talks were still going on, but proportionately less if they had broken off and heavy fighting continued in the south. The South Vietnamese would view the resumption as an indication of the resolve of the United States to continue the war.

In the long-run, the most significant effects of the bombing resumption would probably be on the labor force because between 500,000 and 600,000 workers would continue to be diverted either full-time or part-time from normal civilian occupations to civil and air defense tasks, to repair work, and to assistance in the movement of goods. There would also be a continuing drain of military supplies and equipment, not only material moving down the lines of communication to Laos and South Vietnam but also material associated with the air defense system. In combination, we believe these drains would have the following long-run effects:

1. Hanoi's allies would be required to maintain a high level of military and economic assistance in order to replace losses. This assistance would be largely uncompensated for because exports would be curtailed. Levels of supplies such as those flowing in through Haiphong and over the land lines from China during the first quarter of 1968, however, would appear to be adequate.

2. After an initial period of disruption, Hanoi would be able to cope with the increased costs and difficulty of maintaining essential traffic movements and the current high-level flow of men and supplies to South Vietnam. In summary, the military situation would return to what it was in March, with North Vietnamese countermeasures and increased imports acting as an effective offset to the destruction caused by bombing.

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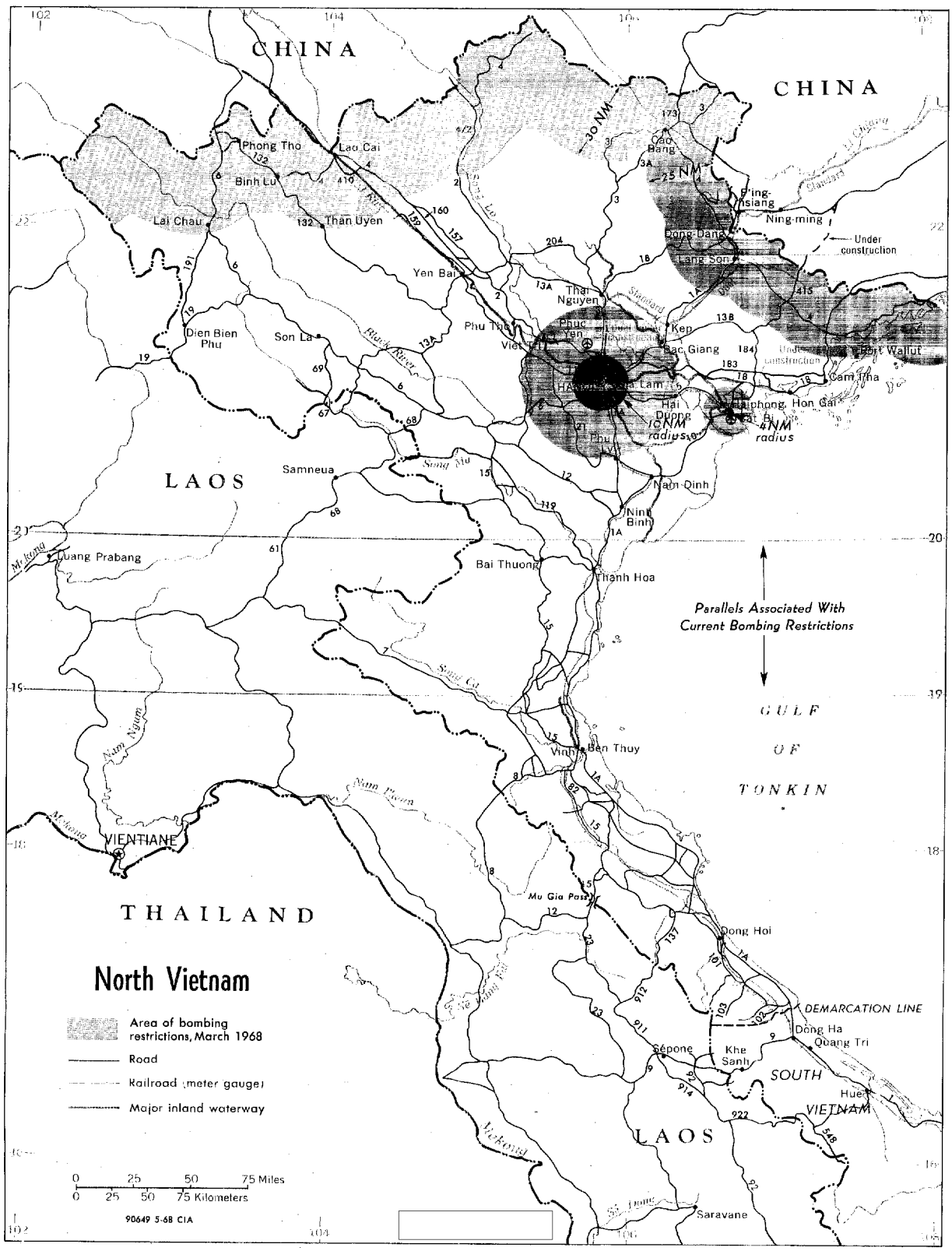

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I. Scale of Rolling Thunder Operations Through 31 March

The intensity and scope of Rolling Thunder air operations have increased each year since the air war began. During 1967, more than 191,000 sorties were flown over North Vietnam, almost as many as were flown in the two previous years combined, and a third of all the sorties flown over Southeast Asia. Approximately 60 percent of all sorties flown over North Vietnam were attack sorties. Ordnance delivered against targets in North Vietnam during 1967 was almost double that during 1966. The average tonnage of ordnance delivered per attack sortie has increased from 1.3 tons in 1965 to 2.3 tons in 1967, largely because of the increasing use of B-52 bombers in the southern part of North Vietnam. Total sorties, attack sorties, and tons of ordnance by US and Vietnamese Air Forces for the years of the Rolling Thunder program are shown in the following tabulation:

Year	Total Sorties a/	Attack Sorties	Tons of Ordnance
1965	55,560	25,880	34,300
1966	147,840	82,170	128,590
1967	191,250	107,070	247,520
Jan-Mar 1968	35,230	14,800	34,000 b/

a. Vietnamese Air Force sorties constitute less than one percent of total sorties.
b. Tonnage is estimated for March.

Unfavorable flying weather restricted the level of attack sorties flown in the first and fourth quarters of each year, as shown in the tabulation below. The unusually low number of sorties in the first quarter of 1968 resulted from bad flying weather, self-imposed bombing restrictions, and the diversion of a number of sorties to operations in the Khe Sanh area.

Quarter	Average Number of Attack Sorties per Month			
	1965	1966	1967	1968
First	280	2,480	6,850	4,930
Second	1,870	5,900	10,590	
Third	3,560	11,450	10,700	
Fourth	2,930	7,560	7,540	

Most of the Rolling Thunder campaign has been directed against targets in Route Packages I, II, and III. Two-thirds of all attack sorties were in these Route Packages in 1967 and about 75 percent in the first quarter of 1968. Attacks against targets in Route Package VI, particularly in the Hanoi and Haiphong areas, were increased in 1967 to about 20 percent of all attack sorties.

Lines of communication have been the principal targets in the air war. Almost one-half of the ordnance delivered against North Vietnam in 1967 was against lines of communication. Slightly less than 40 percent was against non-transport military targets, and a small portion was against industrial targets.

Two-thirds of all the ordnance dropped on lines of communication in 1967 was directed against the highway system. About 25 percent was on roads and trucks; almost 30 percent on road crossings such as bridges, culverts, and causeways; and almost 15 percent on road supply handling areas. The following tabulation shows the distribution of ordnance on lines of communication during 1967, by type of targets:

	Tons			
	Route Segments and Equipment	Bridges, Culverts, and Causeways	Supply Handling Areas	Totals
Roads	28,720	34,285	16,105	79,110
Railroads	2,045	9,315	15,110	26,470
Waterways	9,710	560 a/	1,720	11,990

a. Locks, levees, and embankments are included in this category.

Most of the ordnance on military targets in North Vietnam during 1967 was against ground forces and ground forces installations. About one-third was against military troop areas, one-third against gun emplacements, including antiaircraft artillery, one-fourth against storage and supply areas, and less than 10 percent against airfields, naval bases, radar, and SAM sites.

US losses of aircraft and personnel have been substantial, but aircraft losses have not increased as rapidly as the scale of operations, see the table. A total of 823 fixed wing aircraft and ten helicopters have been lost in combat action over North Vietnam from 1965 through March 1968, and about 1,200 personnel have been reported downed with their aircraft. Aircraft losses have been declining, however, in proportion to the total number of sorties over the past three years.

Attacks against industrial and other targets in heavily defended areas, particularly in Route Package VI which contains Hanoi and Haiphong, have had the highest combat loss rates. Attacks against industrial targets suffered loss rates of 21.4 aircraft per 1,000 attack sorties in 1967, and a loss rate of 17.9 per 1,000 attack sorties was sustained in attacks against targets within 10 nautical miles of Hanoi and Haiphong during the last three quarters of 1967. By comparison, the average for all targets in 1967 was 2.4 aircraft per 1,000 sorties, and losses for attacks against lines of communication were only 2.1 per 1,000 attack sorties.

The cost to the United States of Rolling Thunder air operations has gone up each year with the increasing intensity of the air campaigns. The production cost of aircraft lost, the direct operational cost of sorties flown, and costs of ordnance delivered during 1966, 1967, and the first quarter of 1968 are shown in the following tabulation:

Sorties, Losses, and Loss Rates of US Fixed Wing Aircraft over North Vietnam
1965-67 and January-March 1968

		Sorties [a]	Losses	Combat Losses per 1,000 Sorties
Combat losses				
Attack missions	1965	25,270	129	5.1
	1966	81,360	226	2.8
	1967	106,940	252	2.4
	Jan-Mar 1968	14,800	31	2.1
Total		228,370	638	
Support missions	1965	29,570	39	1.3
	1966	65,660	57	0.9
	1967	84,180	76	0.9
	Jan-Mar 1968	20,430	13	0.6
Total		199,840	185	
All missions	1965	54,840	168	3.1
	1966	147,020	283	1.9
	1967	191,120	328	1.7
	Jan-Mar 1968	35,230	44	1.2
Total		428,210	823	
Combat and operational losses				
All missions	1965	54,840	185	3.4
	1966	147,020	316	2.1
	1967	191,120	366	1.9
	Jan-Mar 1968	35,230	54	1.5
Total		428,210	921	

a. Attack sorties carry out strike and flak-suppression missions. Support sorties make up the remainder, which conduct photo and electronic reconnaissance, combat air patrol, search and rescue, electronic countermeasure, refueling, and forward air control missions.

	Million US $		
	1966	1967	Jan-Mar 1968
Production Cost	605.6	739.0	125.9
Operational Cost of Sorties Flown	330.4	451.2	79.1
Ordnance	311.5	479.2	70.6 a/
Total	*1,247.5*	*1,669.4*	*275.6*

a. Cost of ordnance is estimated for 1968.

In addition to direct costs, there are substantial indirect but unmeasurable costs associated with the bombing.

The direct cost to the United States of inflicting one dollar's worth of damage on North Vietnam declined from $10.98 in 1966 to $7.07 in 1967, but the possibilities of a continued decline are limited as the number of significant economic targets decreases. During the first quarter of 1968, for example, cost of damage inflicted was estimated to be $18.0 million and direct operational costs were estimated to be $275.6 million, an average cost of $15.30 for each dollar's worth of damage inflicted.

II. Effects of the Rolling Thunder Program

A. Value of Damage

The value of measurable damage inflicted on the North Vietnamese by the Rolling Thunder campaign reached $436 million through March 1968. Economic damage reached about $300 million through March 1968, of which about $158 million was inflicted in 1967. Attacks against North Vietnam's military establishment -- SAM's, aircraft, radars, barracks, supply depots, airfields, naval equipment, and the like -- have inflicted additional damage estimated at about

$136 million since the start of the bombing. In addition, North Vietnam has incurred other significant but unmeasurable losses from the bombing. An estimated 500,000 to 600,000 civilian workers were diverted to full-time and part-time repair and defense work related to the bombing. The lot of the average citizen became more trying; families have been separated, some cities have been partly evacuated, and loss of life and property has been substantial. Large quantities of military and economic aid, however -- $1 billion in 1967 alone -- more than offset the cost of damage inflicted by air attacks.

B. Transportation

The rail system has been extensively damaged, but it continues to move a substantial volume of supplies. Attacks against the rail lines have been heaviest on the Hanoi-Vinh line south of Hanoi, and through rail service from Hanoi to Vinh has been effectively halted during much of the air campaign. In mid-June 1967, railroad targets on the Dong Dang and Lao Cai lines in the north and in previously restricted areas of Hanoi, Haiphong, and the buffer zone along the Chinese border were brought under repeated and heavy attack. Key bridges in Hanoi and Haiphong were interdicted for varying periods, hindering through rail service in and out of Hanoi and the port of Haiphong. The Doumer Bridge over the Red River has been out of service for rail traffic about 80 percent of the time since August 1967, and continuously since being extensively damaged by air strikes in mid-December. The Hanoi Railroad/Highway Bridge over the Canal des Rapides near Hanoi has been out of use almost 40 percent of the time since late April 1967. The Haiphong Railroad/Highway Bridge was out of service continuously from 28 September 1967 to April 1968. However, rail service on the Dong Dang line -- the primary overland import route from Communist China -- to the Canal des Rapides Bridge near Hanoi has continued almost without interruption. Elsewhere, at least shuttle service between interdicted points has been maintained and most interdicted rail bridges have been bypassed by multiple ferry and pontoon crossings.

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Despite the Rolling Thunder campaign, the capacity and flexibilities of the rail system have been increased by new construction and improvements -- much of it by Chinese construction units. The Dong Dang line from Ping-h'siang to Kep, and the Thai Nguyen to Yen Vien line, have been converted to dual gauge;* together with a standard gauge route from Kep to Thai Nguyen, these lines provide a standard gauge route from the China border to the Hanoi area with a capacity almost double that of a meter gauge system. Portions of the Hanoi-Dong Dang line south of Kep to Yen Vien are now being converted from meter gauge to dual gauge. In addition, a new rail line is under construction from Kep east to Hon Gai, a secondary port and coal producing area.

The highway system has not been seriously disrupted by the Rolling Thunder program, although the system has been heavily attacked. Most of the airstrikes against highways have been concentrated south of Thanh Hoa along Routes 1A and 15 and against key bridges in the Hanoi and Haiphong areas. Intensive armed reconnaissance strikes have also been maintained against routes leading into the DMZ and Laos. An increased volume of truck traffic has been noted in recent months, however, and substitutes for damaged highway bridges in Hanoi, Haiphong, and elsewhere are less vulnerable and have capacities higher than the roads which they support.

Despite the Rolling Thunder program, the highway system has been continuously improved and expanded, with construction in the north aided by Chinese road construction units. In the northeast, a new all-weather road linking the Ning-ming area of China with Haiphong is near completion and will increase the transborder road capacity to this major Chinese logistic center. In the Panhandle of North Vietnam, Route 101, a major north-south inland alternate to Route 1A, and Route 137, a second major route for infiltration into Laos, have been

** The term "dual-gauge" refers to the use of three or four rails on the same roadbed, making possible the use of both meter gauge and standard gauge rolling stock. It is not to be confused with "double tracking" -- two separate tracks on two or double road beds with a total of four rails.*

completed. A new all-weather road, a third major Laotian infiltration route, is under construction from the vicinity of Dong Hoi toward the southwestern corner of the DMZ. A number of bypass and connecting roads have also been built and many old roads improved. In the northwest, construction and improvement of roads will provide a more direct motorable link between China and northern Laos through North Vietnam.

Inland waterways have not been seriously disrupted by air attacks. The main attacks against inland water transportation have consisted of armed reconnaissance strikes against watercraft and waterway facilities, including transshipment points. In addition, from June 1967 through April 1968, 26,000 MK-36 mines were seeded to harass watercraft and disrupt waterway operations. However, a substantial volume of traffic continues to move over inland waterways, and the North Vietnamese have demonstrated the ability to use mined areas soon after seedings.

Transport equipment has been destroyed and damaged in large quantities, but increased imports and domestic repair and construction have maintained or improved equipment inventories. Pilots have reported the destruction and damage of large numbers of railroad rolling stock, motor vehicles, and watercraft in North Vietnam, and reports of truck destruction increased significantly in early 1968. However, inventories of railroad rolling stock and trucks have actually been increased above the prebombing levels by imports from North Vietnam's allies. Domestic construction of boats and imports of barges and prefabricated barge sections probably have compensated for most of the watercraft losses.

C. Other Economic Target Systems

North Vietnam's modern industries have been either inoperative or operating at partial capacity since the initiation of intensive attacks on industrial targets in early 1967. Electric generating capacity was reduced by bombing to 20 percent of the prestrike capacity of 187,000 kilowatts from June through October 1967. However, the respite from bombing since November 1967 has permitted electric generating capacity to be restored to 30 or 40 percent of prebombing capacity. If the bombing pause continues, output of electric power could

increase to about 60 percent of capacity in about six months. The Thai Nguyen Iron and Steel Plant has been inoperative since being heavily damaged in mid-April 1967. The Haiphong Cement Plant was inoperative for one year until late April 1968, when repairs apparently permitted a test run on at least one kiln. Bomb damage also halted production at the Bac Giang Chemical Fertilizer Plant, the Phu Tho Phosphate Fertilizer Plant, the Lang Chi Explosives Plant, the Viet Tri Paper Plant, and portions of the Hon Gai and Cam Pha coal-processing facilities. In addition, the Viet Tri Chemical Complex was inoperative for a large part of the year as a result of a shortage of electric power. Repairs, however, have permitted at least some production to resume at the Phu Tho Fertilizer Plant, the Viet Tri Chemical Complex, and the coal facilities at Hon Gai and Cam Pha. The direct cost of restoring industry damaged by bombing totals more than $50 million, and reconstruction would require up to two years to complete.

The machine building industry has been relatively undamaged by US airstrikes. Small repair shops and foundries are widely dispersed throughout the country, and the three plants in Hanoi and Haiphong that account for the principal output of machinery and machine tools are within restricted bombing zones. The products and services of this industry are oriented primarily toward support of transportation and of agriculture. In its support of transportation, machine building comes closer than any other domestic industry to direct support of the war in the south. Capacity for machine building and metal processing probably has been enlarged since the beginning of the air war through substantial imports of machinery and equipment. Most imports of machine tools during 1966 were appropriate for repair work and probably were intended for the dispersed repair shops. However, during 1967 a large portion of imports were high-output machine tools, suggesting that the three central machine building plants are engaged in production of significant quantities of agricultural pumps, generators, and diesel engines.

Most of North Vietnam's petroleum storage facilities that existed before the bombing have been destroyed. Use of dispersed tank sites and

petroleum drums, however, has reestablished satisfactory supply and distribution of petroleum products and has enabled the North Vietnamese to maintain a three-month reserve supply of petroleum.

D. Other Economic Losses

The cumulative measurable loss in North Vietnam's seaborne exports attributable to the Rolling Thunder program reached about $35 million at the end of 1967, but these losses have had little adverse effect on the economy. Measurable export losses represented less than 20 percent of the value of North Vietnam's annual exports before the initiation of the bombing program and were small compared with the estimated $340 million of economic aid contributed by the Communist countries in 1967 alone. Stepped-up attacks on industrial facilities during the first half of 1967 accounted for almost one-half of the cumulative export losses. Exports of pig iron and cement have not been observed since May 1967, and exports of coal, which averaged about 78,000 tons per month in 1966, were reduced to only 21,000 tons per month in the second half of 1967.

Agriculture and fishing have been adversely affected by bombing, although neither has ever been targeted nor suffered more than minor accidental bomb damage. The decline in rice output since the beginning of the bombing -- only partly attributable to the air campaign -- has been valued at about $60 million. The agricultural labor force, about 70 percent of the total labor force, has been the main source of manpower for defense and construction work generated by the bombing program. The low per capita productivity of agricultural workers, the unskilled nature of the work, the high agricultural underemployment, and the ready substitutability of women for men undoubtedly mitigated the effects on agriculture of the diversion. The Rolling Thunder program has also contributed, in conjunction with the Sea Dragon Program, to a decline in salt water fishing estimated to be valued at $12.5 million. Despite reduced rice and fish production, however, minimum diets have been maintained by strict rationing, by substituting less palatable foods, and, in 1967, by greatly increasing imports of foodstuffs.

D. Military Targets

The most significant damage inflicted by the Rolling Thunder program on the North Vietnamese military establishment has been against the air defense system, particularly against aircraft. Cumulative destruction of fighter aircraft through the first quarter of 1968 amounted to 32 MIG-21's and 87 MIG-17's. All major airfields except that at Gia Lam, an international commercial airport as well as a military airfield, have been struck repeatedly. Attacks against airfields have forced the deployment of most of the inventory of about 23 MIG-21's and 114 MIG-17's to airfields in southwest China. Numerous early warning and ground-control intercept radars, antiaircraft artillery, and SAM facilities and equipment have been destroyed or damaged, and airstrikes have probably reduced the efficiency of SAM units by forcing frequent redeployment of equipment.

However, countermeasures, imports of equipment, and rapid repair work have offset the damage inflicted to the air defense system. Replacement of MIG-21's from the USSR and MIG-17's from China have been sufficient to maintain North Vietnam's MIG inventory at a relatively constant level. A small effective force of 25 MIG's continues to stage out of North Vietnamese airfields, and the capability of this force has improved. MIG-21 operations have expanded from defensive patrols around the Hanoi and Haiphong areas to areas as far south as Vinh and over the border into Laos. Damage to airfields has been quickly repaired, and all primary jet airfields were capable of supporting fighter operations at the end of March. The North Vietnamese radar system has become increasingly formidable and sophisticated. The proficiency of operating personnel has improved

25X1 with experience and training [redacted] During the past year the North Vietnamese have also maintained an inventory of at least 6,000 antiaircraft artillery pieces of 37-mm or larger and SAM defenses of about 30 active battalions; nearly 200 prepared or pre-surveyed SAM sites are available for use, including six or seven in the vicinity of the DMZ.

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Valuable military supplies, equipment, storage facilities, barracks, and ordnance depots have also been destroyed or abandoned because of air attacks, but the loss of these supplies and facilities has not seriously impaired the overall effectiveness of North Vietnam's military capabilities. Imports of supplies and equipment from the USSR and China have exceeded destruction at depots, and the North Vietnamese have adequately adjusted to the loss of fixed facilities by the dispersal of men and supplies. The North Vietnamese have had no serious difficulty in supporting increased military activity in South Vietnam.

Nearly one-third of North Vietnam's naval base support facilities have been destroyed or rendered inactive, and 12 naval craft have been destroyed by air attacks under the Rolling Thunder program. However, the small North Vietnamese navy -- about 40 patrol boats, gunboats, torpedo boats, and subchasers -- has played a relatively minor part in the war effort, and it has been largely confined to the Hanoi and Haiphong areas to bolster the air defense system.

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POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(THE CASE WHERE THERE IS A COMPLETE CESSATION OF BOMBING IN NORTH VIETNAM, WITH INCREASED ATTACKS AGAINST INFILTRATION ROUTES IN LAOS)

(NO. 8)

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8 MAY 1968

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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
8 May 1968

INTELLIGENCE MEMORANDUM

POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(The Case Where There Is a Complete Cessation of Bombing in North Vietnam, with Increased Attacks Against Infiltration Routes in Laos.) (No. 8)

Summary

This memorandum examines the effects of shifting the weight of the present Rolling Thunder campaign to Laos. There would be a complete cessation of bombing in North Vietnam itself.

A bombing campaign confined to Laos would be directed solely at transportation-logistic targets, since that country's military significance derives very largely from its role as the key infiltration corridor to South Vietnam from the north. However, the transportation-logistic systems in Laos are less attractive targets than their counterparts in North Vietnam, even including the present restricted Vietnamese Panhandle system, which is confined to targets below the 19th Parallel as a consequence of a self-imposed US restriction. The Laotian transport system is a more rudimentary one than the North Vietnamese system. It has a small and declining number of significant logistic targets that are susceptible to detection and attack from the air, and as a consequence, the post-attack repair problems are considerably less burdensome. We believe that concentrating the air effort

Note: This memorandum was produced solely by CIA. It was prepared by the Office of Economic Research and was coordinated with the Office of Current Intelligence and the Director's Special Assistant for Vietnamese Affairs.

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against Laos would have the following direct effects:

1. Increased numbers of trucks, supplies, roads, and bridges in Laos would be destroyed or neutralized, particularly if the United States continues to enhance its capabilities of carrying out night air operations. However, expansion of the capacity of the transporation routes in Laos will soon permit the throughput of 1,000 tons of supplies per day during the dry season and 200 tons during the wet season, in the absence of bombing attacks. The road network is used to only a small share of its capacity; we do not estimate that increased bombings would be able to slow down the present high level of infiltration of men or supplies.

2. The weather and availability of suitable aircraft would impose serious constraints in utilizing the available aircraft sortie capability now devoted to attacking North Vietnam. In 1967, more than twice as many attack sorties were flown against North Vietnamese targets as against those in Laos. But instead of a 200-percent increase in attack sorties, we estimate that the actual increase from the proposed shift to Laos would be closer to 50 percent. Under these circumstances, the present rapid repair schedule could be maintained by the shifting of a small number of repair crews -- not more than 5,000 men -- to Laos from North Vietnam.

3. The North Vietnamese, as soon as they were convinced that the bombing lull over North Vietnam was to be prolonged, would begin shifting more antiaircraft weapons into Laos. Most of these weapons, we believe, would be of small caliber with a few larger conventional antiaircraft guns and perhaps a token number of SAM's. When completed, this shift could triple the present

low loss rate of US aircraft operating against Laotian targets to a level closely approximating that experienced against North Vietnamese targets.

The cessation of bombing attacks on North Vietnam, even though attacks on Laos continued, would be regarded in Hanoi as a propaganda and political victory. The regime would have accomplished one of its major purposes in freeing its territory from aerial attack and it would therefore be encouraged in its belief that the United States would yield to additional pressures. It is unlikely that the proposed shift in the bombing program to Laos would have any significant effect on Hanoi's position with respect to meaningful negotiations with the United States.

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I. Air Operations over Laos

A. Character of Previous Operations

Attack sorties over Laos against the Communist infiltration and logistic system, base areas, and other military facilities during the period 1965 through March 1968 totaled 128,000, about one-half the number flown over North Vietnam.* About two-thirds of the attack sorties over Laos during both 1966 and 1967 were flown in the first and fourth quarters, when the weather was relatively good for air operations. The 22,000 sorties flown during the first quarter of 1968 was the highest quarterly total of the war. Attack sorties over Laos, by quarter, are given in the following tabulation:

Quarter	1965	1966	1967	1968
January-March	440	19,820	17,670	21,880
April-June	2,130	14,190	9,440	
July-September	2,760	4,290	4,580	
October-December	5,500	10,180	14,480	
Total a/	*10,840*	*49,120*	*46,160*	

a. Because of rounding and post-yearly corrections, components may not add to the totals shown.

Air operations over Laos are divided between two operational areas: the Barrel Roll area, extending along the North Vietnamese border in northern Laos, and the Steel Tiger area, roughly equivalent to the Laos Panhandle, extending south from Route 8 to the Cambodian border. These areas are further subdivided into seven alphabetically designated sectors, Alpha through Golf (see the map, Figure 1).

** In addition, 90,000 support sorties were flown over Laos during this period. During 1967, about one-half of the support sorties carried out forward air control missions, 20 percent were reconnaissance missions, 12 percent were combat air patrol and refueling missions, and the remaining were supply, defoliation, and search and rescue missions.*

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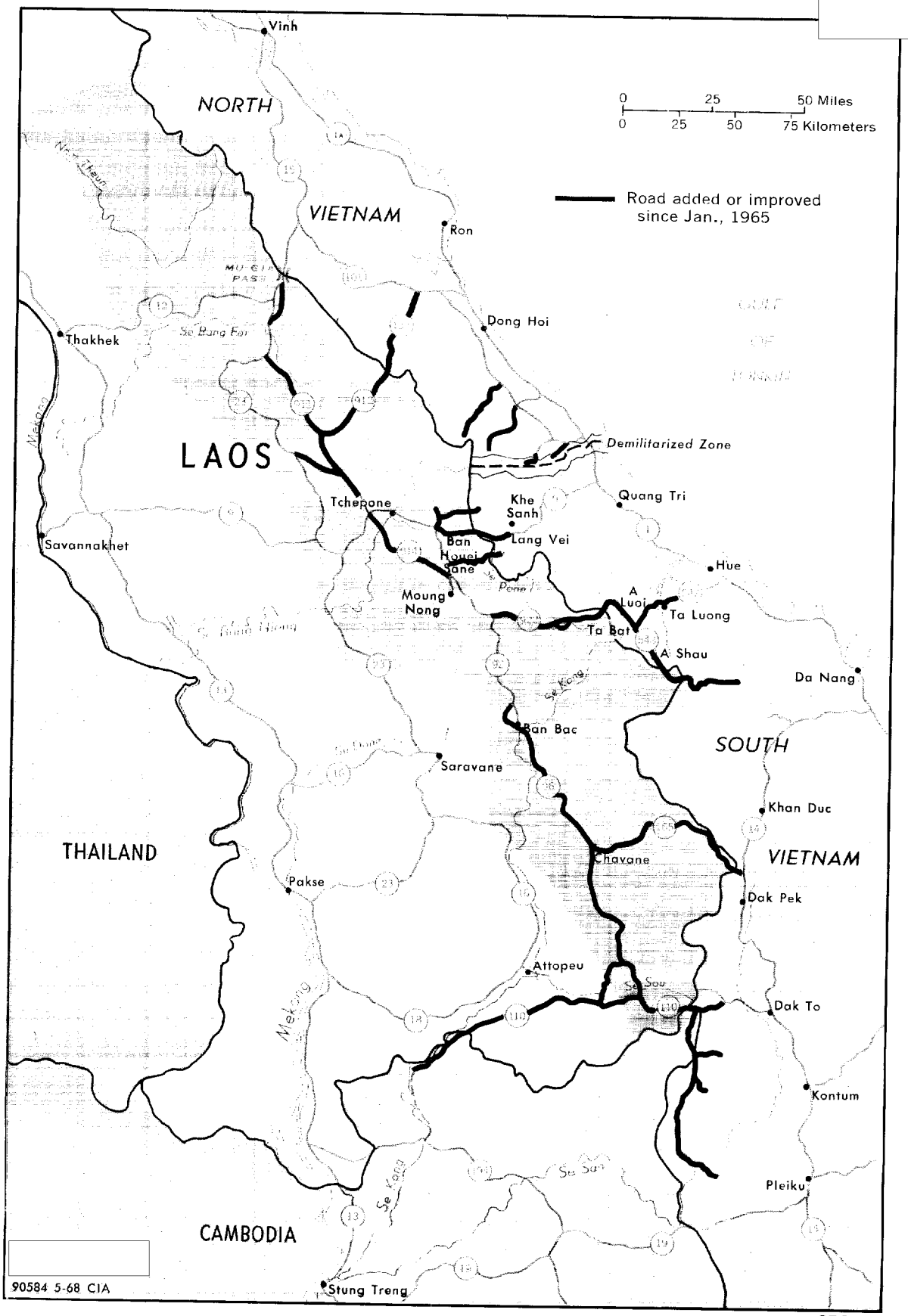

Figure 1. Laos: Road Network and Steel Tiger Boundaries

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About four-fifths of the attack sorties over Laos during 1966 and 1967 were against targets in the Steel Tiger area of the Laotian Panhandle. During the first quarter of 1968, attacks in the Steel Tiger area increased further to almost 90 percent of all attack sorties flown over Laos. During January-March 1968, emphasis within the Steel Tiger area shifted from the Echo sector, adjacent to the major logistical routes from North Vietnam into the Panhandle of Laos, to the Foxtrot sector, just west of the Khe Sanh area of South Vietnam. The share of Steel Tiger attack sorties flown against the Foxtrot sector increased from about 25 percent in 1967 to 50 percent during this period.

Most US sorties continue to be flown during daylight hours, despite the increased use of detection devices (see the Appendix) that have been developed to locate trucks that move largely at night. In 1967 in the Steel Tiger area, there was a ratio of two day sorties to each night sortie. In the fourth quarter of 1967, the ratio changed to one day sortie to each night sortie. However, in 1968 the ratio again returned to two day sorties to each night sortie.

There were 112 combat losses of attack aircraft over Laos during the period 1965 through March 1968.* During 1967, 31 fixed-wing aircraft were downed in Laos by Communist defenses while participating in a total of 46,160 attack sorties -- a loss rate of less than 0.7 aircraft per 1,000 sorties.** Propeller-driven aircraft flew about one-fifth of the attack sorties but sustained almost one-half of the losses by attack aircraft during 1966 and 1967. However, in 1967, attack sorties by propeller-driven aircraft were restricted to less heavily defended areas, and the loss rate

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* *In addition, 33 combat losses of support aircraft, and 20 operational losses of attack and support aircraft, were sustained during the period. Total losses from all causes over Laos, therefore, were 165 fixed-wing aircraft.*

** *The comparable loss rate over all of North Vietnam was 2.4 aircraft per 1,000 attack sorties -- more than three times the rate in Laos.*

by these aircraft fell to about one-half of that sustained in 1966. The trend in combat losses of fixed-wing aircraft and corresponding loss rates over Laos during attack missions since 1965 are shown in the following tabulation:

Year	Attack Sorties	Combat Losses of Attack Aircraft	Losses per 1,000 Sorties
1965	10,840	17	1.6
1966	49,120	47	1.0
1967	46,160	31	0.7
Jan-Mar 1968	21,880	17	0.8
Total	*128,000*	*112*	*0.9*

More than three-fourths of the attack sorties against targets in Laos during 1967 were carried out by 11 different types of jet-powered aircraft, mostly F-4's, F-105's, and A-4's. The characteristics of these aircraft -- high speed, high altitude, and high fuel consumption characteristics -- limit their loitering times and target-spotting capabilities and reduce their attack effectiveness against fleeting targets. Accordingly, most jet strikes in Laos during 1967 were against fixed targets such as truck parks, bridges, supply areas, and defense sites.

Three types of propeller-driven aircraft -- A-1's, A-26's, and T-28's -- flew the remaining attack sorties over Laos in 1967. Most attack sorties by propeller-driven aircraft were against trucks and other moving targets. Attack sorties during 1967 by propeller-driven and jet-powered aircraft over Laos and North Vietnam are given in the following tabulation:

Type of Aircraft	Laos	North Vietnam	Laos and North Vietnam Combined
Jet	35,170	103,350	138,520
Propeller	10,990	3,590	14,580
Total	*46,160*	*106,940*	*153,100*

B. Stepped-Up Attacks Against Laos

Weather constraints and the limited availability of suitable aircraft and technical equipment will probably restrict an increase in attack sorties over Laos to perhaps 50 percent above 1967 levels, and many of the additional sorties would be of marginal effectiveness. About 107,000 additional attack sorties could be made available for use over Laos as a result of a bombing pause in North Vietnam. On the basis of a comparison with 1967 Rolling Thunder statistics, however, most of these sorties would be flown by jets: 85 percent by F-4's, F-105's, and A-4's alone. Only about 6,000 of the jet attack sorties would be flown by A-6 aircraft equipped for radar bombing against fixed targets during poor weather and at night, and only about 3,600 attack sorties would be performed by propeller-driven aircraft. Furthermore, heavy rains and low, dense clouds brought by the Southwest Monsoon generally would sharply limit attacks in Laos during a part of each day from approximately mid-May to mid-September, regardless of the potential number of sorties available. Figure 2, which compares average rainfall and attack sorties over Laos, reflects in part the effect of weather on the sortie rate.

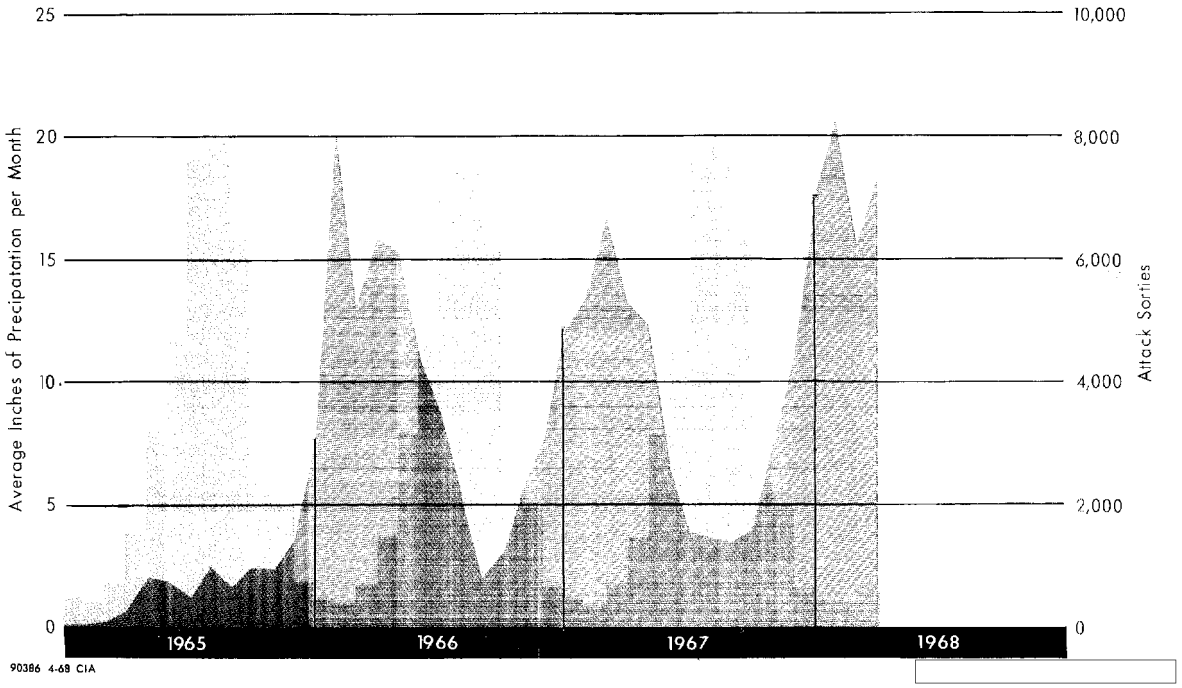

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Figure 2. Attack Sorties Compared with Rainfall over Laos, January 1965-March 1968

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C. Communist Air Defense

Communist air defenses in Laos are composed of at least 15 antiaircraft battalions, with a total of 3,200 air defense personnel and about 150 to 300 14.5-mm weapons and 250 to 400 weapons of 37-mm or larger. The weapons are mobile and difficult to locate and can be deployed in more remote areas where transportation problems hinder the movement of heavier weapons. The 14.5-mm weapons have a maximum effective range of 4,600 feet and are used against low-flying strike aircraft, drones, and helicopters. The 37-mm weapons have a maximum effective range of 8,200 feet. A few 57-mm weapons with a maximum effective range of 19,600 feet may also be in the Panhandle. Thirteen of the battalions have been identified as Pathet Lao, one as a Deuane/Pathet Lao battalion, and one as a North Vietnamese battalion. A minimum of six battalions, about 40 percent of the total air defense strength in Laos, are known to be located in Southern Laos.

In the event the Rolling Thunder program were halted, the air defense system in the Laotian Panhandle could be readily augmented by redeploying as many as 1,500 antiaircraft weapons and 6,000 antiaircraft personnel from North Vietnam without a serious impairment of North Vietnam's air defense capability. About 60 percent of these could consist of weapons of 37-mm or larger. Such a redeployment could be accomplished within a month and would at least double and possibly triple the number of antiaircraft weapons presently in the Laotian Panhandle. Trucks available in North Vietnam could readily transport the required ammunition, and resupply requirements would not impose a significant burden on the transport system.

Up to five SAM firing battalions and one support battalion could be deployed to the Laotian Panhandle from the Hanoi-Haiphong area without seriously impairing the air defense system in North Vietnam. It is probable that any deployment of SAM's in Laos would be restricted to the Echo and Foxtrot sectors of the Steel Tiger area against which most US air attacks in Laos are concentrated. To support five firing battalions, about 25 SAM sites would probably be built. Construction of

the sites and feeder roads would require up to 2,000 engineering workers and would take at least six weeks to complete. The SAM equipment, weighing 3,000 to 3,500 tons, and personnel, numbering less than 1,000, could easily be moved to these sites during the dry season. A more limited and less rapid movement of SAM equipment could be made during the rainy season.

Although the introduction of SAM's into Laos would have considerably more than a nuisance value, it is doubtful if the SAM's would be an effective air defense system in view of the kind of air war presently being fought in Laos. The SAM's have proved to be relatively more effective in defending industrial and fixed lines of communication (LOC) targets in the Northeastern areas of North Vietnam than the fleeting and widely dispersed targets characteristic of the air war in Laos. It is likely, therefore, that the North Vietnamese would deploy only one or two SAM battalions involving five to ten sites in the Laotian Panhandle, thus providing a threat to US strike forces with a minimum expenditure of resources. A system of this magnitude could be completed in less than three weeks, would involve the movement of around 1,000 tons of SAM equipment, and would require up to 700 construction workers and 350 SAM personnel.

A small MIG effort could be conducted against US aircraft over the Laos Panhandle. MIG's can now be staged from an airfield at Vinh and an airfield under construction at Bai Thuong, but it will take six months before construction of the Bai Thuong airfield can be completely finished.

Aircraft losses as a result of these reinforcements in the defense system could be expected to increase, possibly from the 1967 rate in Laos of 0.7 aircraft per 1,000 attack sorties to a rate closer to the average of 2.4 aircraft per 1,000 attack sorties experienced in North Vietnam.

II. The Logistic System in Southern Laos

A. The Road Network

The great bulk of the logistical supplies moved by the Communists into and through the Panhandle

of Laos is moved by truck. The movements are supplemented by primitive transport -- bicycles, porters, and carts -- on innumerable trails and by small craft on a few minor waterways during the rainy season.

The road system has been progressively expanded and upgraded until it now contains more than 1,600 kilometers of road (see Figure 1). During each dry season, engineer units and laborers construct new roads, bypasses, and fords, and repair and improve existing roads. New road construction is usually halted during the rainy season except for short bypasses to keep the routes open. Since 1964 the Communists have added about 1,300 kilometers of roads to the Laotian network.* The most significant routes completed during this time included a second major access road (Route 137/912) into Laos, a limited all-weather road** (Route 92/96) to the tri-border area, and six roads pushed across the Laotian border into South Vietnam. About 670 kilometers of this construction, consisting of the primary trunk road system, was built in the 1965-66 dry season. During the recent 1967-68 dry season, another major construction effort resulted in about 350 kilometers of new roads, mainly consisting of roads extending eastward into South Vietnam. A third major access road from North Vietnam into Laos is also nearing completion, possibly by May or June of this year. Most of the new roads appear to have limited all-weather capability and should remain open to vehicular traffic for a major part of the rainy season.

Currently, there are an estimated 12,000 full-time workers, including engineering units, assigned to repair and maintain the road net in

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** Included in this total are 68 kilometers of roads in North Vietnam (42 kilometers of Route 137 and 26 kilometers of a new unnumbered road) and 127 kilometers of extensions within South Vietnam.*

*** A limited all-weather road has greatly reduced capability in the rainy season, but with proper construction and appropriate maintenance or repair techniques it remains open for a low level of daily traffic during the rainy season except for occasional periods of a few days.*

the Laotian Panhandle, supplemented by some 4,000 part-time laborers or conscripted villagers. The full-time workers also operate ferries and fords and are responsible for traffic control. At the peak of road construction in Laos in 1965-66, an estimated 25,000 workers, comprised mainly of North Vietnamese army troops, were engaged in road expansion.

Materials utilized in constructing and maintaining the Laotian road net are, for the most part, obtained locally. Small amounts of cement, steel, asphalt, and fuel must come from North Vietnam, but there is no apparent shortage of those items required for the primary routes. Only small numbers of bulldozers, rock crushers, and road graders are in the Panhandle, but additional construction equipment could be easily obtained from equipment parks in North Vietnam. A standdown of the bombing in North Vietnam would probably result in a major effort to improve the all-weather capability of the road system in the Laos Panhandle.

About 10 major Communist base areas and many shelters have been built along the supply routes in the Panhandle. These facilities are often located under heavy tree cover or in caves at least several hundred yards distant from the main road. Their locations can sometimes be detected by determining where the trucks leave the main road. The number of such facilities was greatly increased in 1965 and 1966, probably as a result of a step-up in the war and as a countermeasure to aerial attacks.

A network of fixed wirelines apparently intended for logistics functions has been under rapid construction by the Communists since November 1967 from north of the DMZ, through the Laotian Panhandle, and into South Vietnam. The fixed character of the wirelines, involving laborious clearing of vegetation and mounting of poles, testifies to the extent of the North Vietnamese logistical buildup in Laos. Construction of wirelines is under way for more than 300 kilometers, with poles and wires in place for much of the way. The wirelines apparently will parallel supply and infiltration routes at a distance of a kilometer or more from the roads. The precise location of all of the lines is unclear, but the northern end of the network

seems likely to be near Route 101, about 30 kilometers north of the DMZ, where it would link up with the North Vietnamese wireline network. At the southern end, vegetation has been cleared all the way to the A Shau area and slightly beyond. Probably only a Sepone - Ban Bac segment of the network and a north-south line located east of Sepone are operational.

B. Capacity

The capacity of the roads in Laos and the distance that supplies can be moved forward by truck from North Vietnam is steadily increasing. In 1964, Route 15/12 through Mu Gia Pass was the only all-weather route available from North Vietnam into southern Laos. It had a capacity of about 400 tons a day during the dry season and 100 tons a day in the rainy season. At that time, trucks could move south to Muong Nong, a straight line distance of more than 150 kilometers from the Pass, during the dry season. During the rainy season, trucks could move only about 13 kilometers south from Mu Gia Pass. Thus most of the supply movements by truck into Laos took place during the dry season, supplemented by small movements over the trail network around the DMZ during the rainy season. Supply movements south of Muong Nong and east into South Vietnam were totally dependent on primitive transport.

After the major construction of the 1965/66 dry season a total of about 650 (dry season)/150 (wet season) tons a day could enter the Laos Panhandle on the two major access roads, and about 400/100 tons a day could be delivered by truck to several points within a few kilometers of the South Vietnamese border. About 150/30 tons of this total could be delivered about 500 kilometers south to the tri-border area. From these points along the border, primitive transport still had to be used for forward movements.

The routes constructed during the past year and the construction currently under way, however, will provide the Communists with a considerably higher capacity to move supplies by truck into Laos and from Laos into at least four major areas of South Vietnam located between the Khe Sanh area

and the tri-border area. When the third major access road into Laos is completed in the near future, the throughput truck capacity from North Vietnam via Laos into South Vietnam will be about 1,000 tons a day during the dry season and 200 tons a day in the rainy season. The only restricting sector in this pipeline will be Route 92/96 in the southern part of the Panhandle, which limits the movement to the tri-border area to about 200/50 tons a day.

C. Operation of the Transport System

The Laotian supply system is an extension of the North Vietnamese logistical supply system. The North Vietnamese Ministry of National Defense establishes general policies for the procurement of supplies destined to transit Laos, and its General Directorate of Rear Services (GDRS) is responsible for detailed planning and supervision of procurement, storage, issue, and distribution of supplies. The movement of supplies into Laos is controlled by the Transportation Directorate, GDRS, which also furnishes vehicles to units that need them, and North Vietnamese trucks move directly to supply depots in Laos. Transportation in the Communist part of southern Laos is primarily the responsibility of the 559th Transportation Group. This group has two main subordinates: the 70th Transport Regiment, which is responsible for transportation from the Mu Gia area south to the A Shau Valley area and Route 92, and the 71st Transport Regiment, which is believed to be responsible for transportation in the rest of the Panhandle area.

Most supplies are moved at night by truck into base areas and other smaller storage areas located only a few kilometers apart. The trucks travel about eight hours a night at about 10 kilometers an hour with little or no lights. The trucks are probably loaded and fueled in the late afternoon and unloaded, drained of fuel, and camouflaged early the next morning to counter air attacks during the daylight hours. Porters and other forms of primitive transport are used when trucks are not available or cannot be used because of poor road conditions.

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D. Traffic Flows

The daily volume of goods delivered from North Vietnam into the Panhandle has increased markedly during the last three years, as shown in the tabulation below. The increase was especially high in the first quarter of 1968, an estimated 90 percent greater than during the same period last year. Preliminary data for April indicate that traffic may have increased again, by as much as 40 percent above the March level.* There are indications, however, that some of the trucks moving south in recent months have carried troops instead of cargo.

Year	Tons Per Day	Percent Increase Over Previous Year
1965	35	
1966	75	114
1967	95	27

The above estimates are based on roadwatch team reports of trucks counted moving south toward Mu Gia Pass on Route 15. During 1967, for example, an average of 17 trucks a day moved into southern Laos over Route 15. If each truck carried an average load of 3 tons of supplies, then more than 50 tons of supplies would have been moved daily on this route. During 1967 there were no roadwatch teams consistently reporting on traffic movements on Route 137. However, if Route 137 was used to the same percent of its capacity as was Route 15 -- an assumption supported by pilot sightings of traffic on Route 137 -- then about 35 tons per day would have entered Laos over this route. An average of 8 tons a day was believed to have been delivered over trails around the DMZ.

* *Reporting for the first time in over a year from a team located along Route 912 covering about three days in March and most of April indicates that truck traffic on this second major access route may not have been as high since the beginning of 1968 as has been estimated. However, this team is located about 3 kilometers from the road and, therefore, may not be able to see or hear all the truck traffic moving past it on the road. There is ample other evidence that the total traffic into Laos has been increasing throughout this dry season. Furthermore, traffic during April is normally the highest of any month of the year, as preparations are made for the rainy season that usually begins in May.*

III. Air Attacks on the Logistics System

A. Truck Losses

The North Vietnamese have lost an estimated 5,300 trucks in Laos since 1965. Reported truck losses have increased dramatically since the fall of 1967 and have continued at a high level in the first quarter of 1968. Almost as many trucks were lost in the first quarter of this year as in all of 1967. During 1967, 22 sorties were flown for each truck destroyed, but since January 1968 the ratio has been 11 to 1. Estimates of the yearly losses in Laos are given in the tabulation below:

Year	Effective Truck Losses
1965	45
1966	1,153
1967	2,072
1968 (Jan-Mar)	2,039

a. To arrive at an estimate of effective truck losses in both North Vietnam and Laos, pilot reports are first adjusted to eliminate double counting. Then a deflation factor is applied to adjust for inaccuracies in the data and for the North Vietnamese ability to repair and rebuild trucks. Inaccuracies are caused by high aircraft speeds; poor visibility resulting from weather, smoke, and dust after attacks; night operations; and intense antiaircraft fire. The formula for computing effective losses used by CIA and DIA is as follows: 75 percent of those trucks reported destroyed and 25 percent of those reported damaged are considered to be effective losses and are deducted from the inventory. For 1966, however, the number of trucks reported destroyed and damaged was further deflated by a factor of 20 percent.

Some of the increase in truck losses is due to the high number of sorties flown at night, when the majority of the trucks are operating; the increased use of Forward Air Controllers in spotter aircraft; and the increased use of new technical devices to detect and attack trucks. The new technical devices (see the Appendix) have enabled aircraft to more effectively attack moving targets at night.

The unusually large number of trucks reported destroyed, however, particularly in the first quarter of this year, may be overstated. Part of the reported losses may be the result of changes in pilot criteria for reporting numbers of trucks destroyed, compared with the number damaged. In Laos during January-September 1967, 62 percent of the trucks were reported as destroyed, while 38 percent were reported as damaged. In North Vietnam the ratio has been about one to one. In the last quarter of 1967 and the first quarter of 1968 the ratio in Laos has changed to nine reported destroyed to one reported damaged. It is not clear why the ratio should have changed so dramatically, and it is possible that the formula (see the footnote to the tabulation above) for computing effective losses should be revised to further deflate pilot reports of enemy truck destruction. Many of the trucks reported destroyed or damaged by pilots were attacked at night, when it is extremely difficult to assess the effectiveness of an air attack.

Data from roadwatch teams also indicate that data on truck losses may be overstated. The team at Mu Gia Pass, one of the entrances to the road net in the Laotian Panhandle from North Vietnam, has reported slightly more than 3,700 trucks moving southbound and slightly fewer than 3,700 trucks moving northbound between October 1967 and March 1968; yet during the same period, 3,200 trucks were effectively lost according to pilot reports. Recent reports from roadwatch teams on Route 912, although incomplete, indicate that approximately the same volume of traffic on that route is moving northward as is moving south.

Furthermore, there has been no apparent shortage of trucks in either North Vietnam or Laos. Compared with reported losses of about 10,500 trucks in the two countries from 1965 through the first

quarter of 1968, imports of more than 13,000 trucks during the same period have increased the North Vietnamese truck inventory from about 9,000 trucks at the beginning of 1965 to more than 11,000 at the present. Each year, newer and larger trucks have been observed in Laos by roadwatch teams and in aerial photography. If truck losses have in fact increased sharply, the USSR and East European Communist countries could step up their supply of vehicles because production rates are ample.

B. Supply Losses

The total loss of supplies sustained by the Communists in Laos is now assumed to be about 20 percent of the tonnage delivered into Laos. In 1967, 8 percent of the supplies moved into the Laos Panhandle may have been lost as a result of the destruction of trucks, with about five trucks a day destroyed. If half of these trucks were loaded with three tons of supplies -- trucks delivering supplies would probably be fully loaded, trucks returning would probably be empty -- about 7.5 tons of supplies were destroyed daily, compared with the 95 tons of supplies moving into the Laos Panhandle. Daily destruction of trucks in the first quarter of 1968 has reportedly been four times the daily rate in 1967, raising the calculated losses of supplies to 30 tons a day, or 12 percent of the 240 tons of supplies per day estimated to have been moved into the Laos Panhandle during the same period. In addition to the direct loss of cargoes resulting from destroyed trucks, the Communists also suffer losses from air attacks on storage depots and base areas and suffer additional losses from pilferage, spoilage, or other normal causes. The above estimates of supply losses are extremely tenuous, however, because of the limited amount of intelligence available on losses.

C. Fixed Targets

During 1966 and 1967, pilots flying attack sorties over Laos reported destroying or damaging a total of about 24,000 fixed targets. More than one-third were roads cratered or cut, one-quarter were buildings, one-quarter were ammunition and supply areas and miscellaneous targets, and the remainder were weapons, bridges, and tunnels.

Numbers of each type of fixed target reported by pilots to be destroyed or damaged in Laos during 1966 and 1967 are given in the following tabulation:

	1966	1967	Total	Percent
Road craters or cuts	4,146	4,605	8,751	37
Buildings	4,731	1,758	6,489	27
Ammunition and supply areas and miscellaneous	3,294	2,186	5,480	23
Bridges and tunnels	1,258	397	1,655	7
Weapons	536	855	1,391	6
Total	*13,965*	*9,801*	*23,766*	*100*

Attacks against fixed targets have had little lasting effect on the logistics system. There has been a sharp decrease in the number of buildings, storage areas, and bridges attacked in 1967 compared with 1966, reflecting the inability of pilots to find suitable targets under the jungle canopy. Road cuts and craters -- about one cut or crater daily per 150 kilometers of road in the Panhandle during 1967 -- have not seriously impeded traffic flows, and the roads have been quickly restored.

D. Increased Air Attacks

An increase in attack sorties over Laos made possible by a cessation in the bombing of North Vietnam would increase the cost and complicate the movement of supplies through Laos; however, it would not likely be any more successful than previous attacks in reducing the flow below that needed to maintain enemy forces in South Vietnam at present or even increased rates of combat. Bridges, buildings, and storage areas would be more heavily attacked, but Laos has a small and declining number of significant fixed targets that are susceptible to detection and attack from the air. Even if the unusually high reported loss rate of trucks in the first quarter of this year is accurate and is sustained, losses of

trucks and supplies could be made up by increasing the volume of traffic, by bringing in more trucks from North Vietnam, and by importing additional trucks from the USSR and Eastern Europe. Transport routes have considerable excess capacity -- the road network has not often been used to more than 15 percent of capacity in the past -- and even with increased bomb damage, the network could support increases in traffic flows caused by the need to make good a greater loss of supplies, increased consumption within Laos, or higher levels of combat in South Vietnam. The rudimentary road system is easily repaired, and the present repair force could be quickly augmented by relocating repair crews idled by a bombing pause in North Vietnam. Furthermore, an increase in air attacks would almost certainly be countered by an increase in air defenses, which would lower the accuracy of attacking aircraft.

IV. Personnel Infiltration System in Southern Laos

A. Infiltration Intelligence

Intelligence on the numbers and timing of North Vietnamese infiltration of troops through Laos into South Vietnam is limited but improving.

Aerial photography and air observers are of little help in providing additional evidence of infiltration because the trails used are covered by the jungle canopy. Friendly guerrilla teams occasionally report troop movements in the Laos Panhandle but can provide few details.

Most of the intelligence on the infiltration network has been derived from captured documents and prisoner interrogations; this information is still somewhat limited, however, because of the compartmentation applied to all phases of the infiltration system. For example, prisoners have reported that way stations on the infiltration trails are usually located about a kilometer away from the bivouac areas used by the infiltrating troops. Apparently, only the commanding officer, communications personnel, and occasional supply carriers from the infiltrating groups are permitted to go to these base areas. The same principle is applied in keeping base personnel at adjacent way stations from knowing the locations of each other's sites. Those who are assigned to guide infiltration groups customarily meet their opposite numbers from the next station at some intermediate point along the trail and pass over control of the groups at that time. Nevertheless, a good deal has been learned about the infiltration network from captured documents and personnel.

B. Infiltration Network

All infiltration groups transiting Laos are supported and controlled by an effective organization of administrative, logistic, communications, and transport personnel. This system extends over a complex network of trails as far south as the delta region below Saigon, through lengthy portions of eastern Laos and Cambodia, and extreme western South Vietnam.

Way stations are scattered along all the infiltration trails at intervals of about a day's march. In much of North Vietnam these stations are established in or around villages or hamlets, but, as the infiltration routes approach the North Vietnamese border and pass into Laos, sites are selected in remote jungle areas. Way stations have two major functions: to provide rest and replenishment areas for infiltrating personnel and a base for the individuals who control and support the infiltrators. The stations vary in their facilities

from mere stopping points in the jungle to major depots equipped to provide food, shelter, and medical care.

The infiltration network is highly efficient. Small craft are provided at every water way which the infiltrators cannot ford. Prisoners have reported little delay or confusion at these potential bottlenecks and have remarked on the competence of the network personnel.

C. Level of Infiltration

Hanoi probably has committed more than a quarter of a million men to the conflict in the south

Infiltration groups have ranged in size from about 20 to 2,000 men. The small groups probably are composed of personnel whose unique training or responsibilities justify the formation of a special infiltration unit. The larger units appear to be made up of regular army formations or groups of unassigned replacement personnel. The typical infiltration group is battalion size -- about 400 to 500 men. This figure probably represents a practical number in moving personnel on the infiltration trails and suggests that large groups are subdivided into marching elements of about this size. In the case of a regular North Vietnamese battalion, the component companies appear to move separately at intervals of a few kilometers between each unit. Infiltrating battalions are normally separated by at least a day's march.

The infiltrators are usually not accompanied or supported by supply vehicles on the trip south. Bicycles may, however, be employed to carry some items of heavy equipment, such as communications gear. Each man carries his own food, medicine, field equipment, and weapons and is periodically resupplied from depots along the route of march. The infiltration groups are kept apart from the supplies that they will eventually use in South Vietnam.

D. Method of Movement

The great majority of the infiltrating personnel have proceeded on foot, although current prisoner interrogations have suggested that a substantial percentage of the infiltration during the first quarter of 1968 has been accomplished by truck. Over the years, however, infiltration by vehicle has been confined to high-ranking cadre or individuals with special skills -- such as medical or weapons technicians. Prisoners have indicated that infiltration by truck can be accomplished in two weeks or less; by foot, at least six to eight weeks are required. Infiltrators shift from a night to a day march schedule on entering Laos from North Vietnam, probably because US air interdiction efforts are less intense in Laos and because of the concealment afforded by heavy jungle growth in this region. The group normally sets out about 0600 and will march for about six to nine hours, depending on terrain.

Every effort is made to conceal the presence of the unit. For example, temporary planking is used when crossing dirt roads in order not to leave footprints. Infiltration groups are careful to keep away from main lines of communications in Laos. Prisoners have reported hearing supply trucks on parallel routes, but for the most part, the infiltrators move on trails which are a safe distance from the often-bombed supply roads.

E. Attrition

Infiltrators face a variety of perils on the way south. Malaria is the most frequent problem encountered by the infiltration groups. Reports from captured troops indicate that among some groups as many as 100 percent of the infiltrators contract this disease in varying intensity at some point during the march south. Each man is supplied with anti-malaria medication, however, and most are able to complete the trip. Dysentery, beri-beri, and respiratory diseases also are reported to plague the infiltrators. Morale declines in response to the increasing hardships as the troops move south, particularly during the rainy season. The proportion of personnel lost en route varies widely, captured documents and prisoners reporting from 5 to 50 percent. It is likely, however, that very few casualties

are permanent and that after a period of recuperation or re-indoctrination, the detained individuals join another group and continue south.

V. Attacks on the Personnel Infiltration System

Air strikes in Laos have not had an appreciable effect on personnel infiltration, and intensifed air strikes are not likely to. Air harassment has probably indirectly increased the sickness and desertion rates. Several prisoners of war have recounted being bombed by US aircraft. Air attacks on occasion may have made the resupply of food and medicines to way stations in Laos difficult. However, interrogation of infiltrators who traversed the trails during 1967 indicates that a small number of those leaving North Vietnam became casualties of air strikes.

APPENDIX

New Detection Systems In Laos

Several new detection systems recently introduced in Laos have significantly increased the cost to the enemy of moving supplies from North Vietnam to the south. Most enemy traffic in Laos moves by truck at night, and previously with little risk of detection and destruction. These new devices have enabled Allied air operations to increase the detection and destruction of trucks and other logistics targets at night.

1. Starlight Scope

The Starlight Scope is a device used for night observation which passively captures and intensifies ambient light emitted from the sky, ground, and general surroundings without emitting any light itself. It does not see through direct obstacles to vision such as low clouds, jungle canopy, and terrain features such as hills and trees and can be limited in effectiveness by small differences in contrast between target and background. The smallest and most common model of the Starlight Scope weighs six pounds and is about one-half meter in length. It has a field of view of 10 degrees and is capable of identifying a human-sized figure at 400 meters. The Scope may be attached to a rifle or used as a hand-held observation piece. The most fruitful application of the Starlight Scope has been in Forward Air Control missions in the Laos Panhandle where it has played an important role in the recent increase in sightings and destruction of enemy trucks. The Scope is in use as a hand-held observation piece by all Forward Air Controllers in the Steel Tiger area. Starlight Scopes also have been provided to roadwatch teams and to some armed helicopters.

2. Night Observation Device

The Night Observation Device is used aboard C-130 aircraft and armed helicopters. It weighs forty pounds, is mounted on a tripod, has a range of up to 1,000 meters on a moonless night, and

provides better resolution and a larger optical gain than the Starlight Scope. The effectiveness of the Device is enhanced on C-130 aircraft by the presence of other equipment such as a Xenon searchlight capable of providing light in the ultraviolet and infrared spectrums as well as the visible spectrum. This enables the Device, with its limited field of view, to be trained more quickly on suspect targets. Only small quantities of the Night Observation Device are currently available, but production is now being accelerated. The Device is not used on high-performance jet aircraft because its effectiveness would be limited by the speed and altitudes of these aircraft, the visibility limitations imposed by canopies, the small field of view of the Device, and the need for viewing through an eyepiece.

3. Low-Light-Level Television

The Low-Light-Level Television (LLLTV) consists of a light intensifier tube similar to that used in the Starlight Scope connected to a TV camera tube with a standard TV display. The LLLTV has a 20-degree field of view -- double that of the Starlight Scope. The TV screen is a more convenient viewing mode than the eyepiece of the Starlight Scope, although it has a slightly degraded image compared with the Starlight Scope. The TV apparatus can be tied in with a camera and is particularly useful in conjunction with fire-control equipment. The LLLTV system is currently in use on three B-57's flying missions over Laos and South Vietnam. An LLLTV system with a longer range and an improved image display is planned for installation on some sixteen B-57's by March 1969. An improved system is also planned for installation with a fire-control system on several UH-1 helicopters in 1969.

4. Aerial Surveillance Device

The Aerial Surveillance Device will, when deployed, augment a Starlight Scope or LLLTV on helicopters; it will utilize a pulsed laser illuminator to provide better target contrast when a target is viewed through a Scope or on a TV screen. Some three or four devices are expected to be in operation soon.

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5. Infrared Sensors

New infrared sensors permit fast detection by aircraft of heat-emitting vehicles and campfires. Earlier infrared systems did not provide advance notice of targets being approached by high-speed aircraft because the detection systems were aimed directly downward and had to photograph infrared emissions before alerting pilots to targets. Current systems are "forward looking" and provide immediate target information to pilots. The system's effectiveness is limited over heavy jungles and by occasional incorrect target identification caused by emissions of heat from land masses or bomb craters.

6. HARK-1

HARK-1 is a radio-counter used by indigenous, non-English-speaking roadwatch teams in Laos to notify Allied forces of the type and quantity of observed enemy traffic. The observer turns picture-labeled knobs, pushes a button, the device relays information to a plane flying on station, and equipment on the plane relays the information to a teleprinter at a ground station. About 200 of these units have been made available to roadwatch and guerrilla teams operating in Laos and South Vietnam.

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DIRECTORATE OF
INTELLIGENCE

Intelligence Memorandum

POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(THE CASE WHERE THERE IS A COMPLETE CESSATION OF BOMBING IN NORTH VIETNAM AND LAOS.) (NO. 9)

Secret

24 APRIL 1968

WARNING

This document contains information affecting the national defense of the United States, within the meaning of Title 18, sections 793 and 794, of the US Code, as amended. Its transmission or revelation of its contents to or receipt by an unauthorized person is prohibited by law.

Declassified in Part - Sanitized Copy Approved for Release 2011/12/08 : CIA-RDP78T02095R000400070001-8

CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
April 1968

INTELLIGENCE MEMORANDUM

POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(The Case Where There Is a Complete Cessation of Bombing in North Vietnam and Laos.) (No. 9)

Summary

This memorandum analyzes the anticipated effects of a cessation of the present Rolling Thunder program. Present geographic restrictions, which apply only to North Vietnam, permit attacks on targets below the 20th Parallel. This self-imposed US restriction has removed the main industrial areas and transportation centers of North Vietnam from exposure to bombing attacks. It has, in turn, given a clear-cut indication of Hanoi's probable actions in the face of a complete cessation of attacks. Since the present US geographic bombing limitations began, the North Vietnamese have been making temporary repairs to key rail and highway bridges in the northern areas and restoring the damaged, but repairable, portions of electric power generating capacity.

We believe that a full bombing halt against both North Vietnam and Laos would probably bring about the following short-term results:

Note: This memorandum was produced solely by CIA. It was prepared by the Office of Economic Research and was coordinated with the Office of Current Intelligence and the Director's Special Assistant for Vietnamese Affairs.

1. The extension into the Panhandle of the program for the full restoration of through service on the principal rail and highway links, by repairing key bridges which are currently out. Mines would also be removed from the inland waterways.

2. In consequence, this restoration not only would permit the more efficient movement of goods within North Vietnam, but also would improve the capability of moving war-supporting supplies into the North Vietnamese Panhandle, and into Laos. The efficiency of truck operations would be vastly improved because daylight movements would be greatly increased and the need for camouflage and evasive action would be ended. Much larger tonnages of logistic support and increased numbers of personnel could be moved through Laos to South Vietnam with no increase in the size of the truck inventory.

3. The improvement immediately of morale and living conditions of the North Vietnamese people would ensue. Within the six-month period, many civilians who had been evacuated from urban areas would return to their homes.

4. The redeployment of a small portion (perhaps 15 percent) of antiaircraft strength to South Vietnam to afford protection for VC/NVA operations in that area would be possible. This might entail the movement of 1,500 weapons and about 6,000 men.

5. North Vietnam would be capable of redeploying a few thousand additional troops to the south, but there would probably be no significant immediate redeployment since the initial logistic repair effort would absorb about the same size force as is currently employed on maintenance of lines of communication. Casualties, which reached a level of about 36,000 in 1967 as a result of the Rolling Thunder campaign, would come to a halt.

6. A clear-cut propaganda and political victory would be seen, in Hanoi's view. It would see the United States forced to take action as a result of political pressures. The regime would be encouraged in its belief that the United States would ultimately tire of the war and that Hanoi's firm policy had forced the United States to retreat.

In the long run, if the bombing halt persisted, Hanoi would be encouraged to move from a program of temporary repairs to one of full rehabilitation of industry and transportation. The regime is known to have developed detailed plans for the post-war period. A continuation of the bombing pause beyond six months would probably tempt Hanoi to put its long-term rehabilitation plans into effect, unless the state of the war were such that an early resumption of US air action appeared to be imminent. The long-term effects, apart from the increased possibilities of full economic restoration, would be:

1. An improvement in agricultural output as more domestic fertilizer and agriculture equipment were made available. Given normal weather conditions, most, but not all, of the food deficit would probably disappear.

2. The addition of perhaps 100,000 to 150,000 men to the manpower pool as the restoration of the transportation system was completed. They would be available for military training and eventual redeployment to South Vietnam if Hanoi believed such redeployment could safely be carried out -- that is, if Hanoi believed that large-scale bombing against the north probably would not be resumed.

I. Impact on the Economy of North Vietnam

A complete standdown of the Rolling Thunder progam would afford the North Vietnamese an opportunity to begin a general program for restoration and reconstruction of economic damage. During the short run -- the first six months -- the primary effort would be to begin the restoration of the electric power industry. Evacuated civilians would return to the cities, and there would be a significant immediate improvement in living conditions and morale. Productivity would quickly improve, particularly in transport, construction, and manufacturing. A bombing halt would have little impact on agriculture in the short run, the fifth-month rice crop already being planted.

An extended standdown on the order of one to two years would result in major progress being made in repairing bomb damage throughout North Vietnam, but only if the Hanoi leadership believed there was no likelihood of the resumption of the bombing. The restoration of all damaged industries, and the planning of new industries, some of which are already contracted for, would probably be well advanced. Those manufacturing processes that have not operated efficiently under the dispersal program would be returned to urban areas. Agriculture might make some progress toward increased yields, but this is generally a longer range problem that involves changes of deep-seated practices. The speed with which the reconstruction effort progressed would be largely dependent upon the material and technical assistance the North Vietnamese obtained from the USSR, the Eastern European countries, Communist China, and Free World countries.

A. Industry

A cessation of the bombing probably would result in only nominal improvement of North Vietnam's industries in the short run. Full recovery would require from one to two years and involve reconstruction, some relocation from dispersed sites, and foreign technical and material assistance. North Vietnam lacks the necessary skilled labor force, raw materials, and finished goods to construct

modern industries by itself. Industries that supply essential services, support agriculture, and earn foreign exchange are most likely to be reconstructed first, and in that order.

Restoration of the electric power industry will be a formidable task because the power industry has sustained the heaviest damage of any North Vietnamese industry. At present, only about 40 percent of the total nationwide pre-bombing generating capacity is in operation. Moderately damaged equipment probably could be repaired within six months, and such repairs would increase serviceable capacity to about 60 percent of the pre-bombing national total. Much of the remaining equipment, however, is so severely damaged that increases of capacity beyond this level would require major reconstruction and time periods of up to two years for full restoration (see Table 1). Restoration of many undamaged industrial facilities presently not in operation can be accomplished by restoration of damage to electric power facilities. Several heavily damaged electric powerplants probably will be scrapped and entirely new electric power facilities constructed.

Some industrial plants would be back in partial production within six months, although several of the heavily damaged plants would require one to two years to be completely repaired (see Table 2).

The Haiphong Cement Plant was severely damaged by bombing raids in April and May 1967 and has been inoperative since that time, but the North Vietnamese have already started repairs and have begun negotiations with Rumania to import machinery for the plant. Delivery is scheduled in 1969 for much of the new equipment, although some motors were delivered in late 1967. The plant could probably be placed in partial operation within six months at 20 to 30 percent of its original capacity of 700,000 metric tons per year. It would take about two years to restore the plant to original capacity.

Table 1

Estimated Restoration of Damaged Electric Power Generating Plants Six Months after a Bombing Halt a/

Powerplant	Pre-Bombing Capacity (Megawatts)	Serviceable Capacity (Percent)	
		April 1968	Six Months Later
Hanoi	32.5	75	75
Haiphong West	10	0	50
Haiphong East	7	0	0
Viet Tri	16	25	50
Thai Nguyen	24	25	50
Bac Giang	12	50	100
Uong Bi	24	0	50
Hon Gai	15	20	33
Nam Dinh	7.5	33	67
Thanh Hoa	5	50	50
Ban Thach	1	100	100
Co Dinh	1.5	0	0
Ben Thuy	8	0	25
Subtotal	163.5	30	55
Other (undamaged)	23.5	100	100
Total	*187.0*	*39*	*60*

a. Total restoration in most cases will require one to two years.

Table 2

Estimated Recovery Times for Selected Large Manufacturing Plants

	Current Status as of April 1968	Projected Operational Status	
		Six Months Later	One to Two Years Later
Thai Nguyen Iron and Steel Complex	Out of operation	Limited, one-third prestrike capacity	Full
Haiphong Cement Plant	Out of operation Construction work in progress	Limited, one-fifth capacity	Full
Nam Dinh Textile Plant	Finishing shops in operation	Limited, one-fourth capacity	Full
Hanoi 8th March Textile Plant	Partially dispersed; finishing shops in operation	Full	
Viet Tri Paper Plant	Out of operation	Full	
Bac Giang Chemical Fertilizer Plant	Out of operation	Full	

Frequent bombings of the Thai Nguyen Iron and Steel Complex during March-June 1967 destroyed or damaged much of the complex. A number of the workshops and fabricating buildings were destroyed or damaged; the coke by-product plant, the coke battery, the sintering building, all three blast furnaces, and a number of ancillary facilities were rendered useless. The incomplete open hearth and rolling mill buildings were also heavily damaged, as were research facilities and administrative

buildings. Since the end of June 1967, the plant has been completely inoperative. The plant could be restored to one-third of its pre-strike capacity to produce pig iron in about six months, but complete restoration and the completion of steel making facilities previously under construction that had never been completed would take two years.

Relocation of dispersed shops of manufacturing plants probably would be one of the first steps in recovery. The only known dispersals of relatively large plants, however, include the Hanoi 8th March Textile Plant, the Nam Dinh Textile Plant, and the Haiphong Fertilizer Plant. Much-publicized claims of industrial dispersal appear to have referred to small and light industrial establishments such as handicrafts, repair shops, and some sections of the two textile mills.

Export of industrial commodities other than coal is not likely to change significantly in the short run. Resumption of pig iron and cement exports will require full reconstruction of damaged manufacturing facilities. Repair of bomb damage to coal-processing facilities, however, has allowed a steady increase in the export of coal since September 1967, bringing the current level to about 60 percent of that maintained during the first quarter of 1967. The pre-strike level of coal exports probably could be attained within six months.

The North Vietnamese apparently have already been preparing for the reconstruction that would follow a permanent cessation of bombing. During 1967, formal negotiations were conducted with Communist and non-Communist countries for assistance in rebuilding a number of destroyed plants. Most of the negotiations involved preliminary estimates and surveys, and frequently resulted only in agreements for the services of specialists and technicians or for training. Deliveries of machinery and equipment for basic industry under contracts signed in 1967 were usually deferred, in some cases until late 1968. A North Vietnamese industrial delegation visited Paris in the fall of 1967 to discuss post-war construction with a number of French firms. More substantial talks are expected when the war

ends. In addition, about 20,000 North Vietnamese are expected to receive training in Communist schools and industries between now and 1969. These students will augment the technical labor force that will be required to operate the post-war economy.

B. Agriculture

A bombing standdown would have no noticeable effect on North Vietnam's agricultural output over the next six months. The fifth-month rice crop, supplying about one-third of the annual output of rice, has already been transplanted, with harvesting to take place in late May and early June. It is possible that the tenth-month rice crop could be improved if the preparation of the crop could be accomplished without the disruptions from bombing.

A continued bombing halt would permit the Vietnamese to increase agricultural output slightly, if the regime continues to import fertilizer and increases imports of agricultural machinery and if improvements are made on the water control system. However, agriculture has been tradition-bound in North Vietnam for centuries, and dramatic increases in output in the short run or even over a two-year period cannot be expected. Furthermore, immediate agricultural prospects are highly dependent on unpredictable weather conditions.

Rice production has declined during the last two years of the bombing from a normal level of 4.5 million tons in 1965, to an estimated 4.2 million tons in 1966 and 4.0 million tons in 1967. The decline in the last two years was due partly to adverse weather and a shift from rice to subsidiary crops.

Bombing has had only a marginal effect on agricultural output because of the low stage of agricultural development. North Vietnamese agriculture is extremely primitive and a majority of the large agricultural labor force is engaged in

producing rice, the basic foodstuff. The agricultural labor force accounts for about 70 percent of the total labor force and includes a large percentage of women. Seasonal unemployment and underemployment are typical.

The primary detrimental effects of the bombing have been the diversion of manpower, particularly managerial cadre, to military and war-related activities; the daily interruptions of routine agricultural chores for manning antiaircraft guns or taking cover in shelters; and the disruptions to the manufacture and distribution of fertilizer and other farming input materials.

The level of agricultural imports would be little changed during the first few months of a bombing pause, but imports could decline substantially thereafter. North Vietnam has been heavily dependent on imports of food to supplement domestic output since late 1966. During an extended bombing halt, food imports probably would drop back to the pre-bombing level of about 200,000 tons from the high of about 450,000 tons imported in 1967. North Vietnam now imports about 160,000 tons of nitrogenous fertilizer a year. In the short run, this level of imports probably would continue. Over a one or two year period, as domestic facilities began producing nitrogenous fertilizer, the volume of fertilizer imports probably could be reduced. Phosphatic fertilizers are obtained from domestic sources and are not imported.

C. Civilian Manpower

A cessation of the bombing will not immediately free large numbers of persons for military duties. The bombing has required the diversion of less than 200,000 full-time civilian workers, both men and women, young and old, to repair lines of communication (LOC's) and to move supplies. Only a small number of these workers are physically fit males of military age. A cessation of the bombing probably would not free the diverted full-time workers over the short run, in view of the amount of bomb damage already sustained which must be repaired and the ever-present

possibility of a resumption of the bombing. Over the long run, some of these diverted full-time workers would be available for reassignment. An additional 300,000 to 400,000 workers are currently required part time for repair, reconstruction, transport, and civil defense when local conditions demand. An estimated 100,000 of these part-time workers are mobilized in their local areas to man civil and air defense posts and would not be needed during a bombing halt. Some of the remaining part-time workers who are engaged in repairing LOC's and moving goods probably would continue this work during a bombing halt, at least in the short run. In the long run, perhaps 100,000 to 150,000 would be available for other purposes, including military duties.

D. Living Conditions

A bombing halt would immediately improve the morale and living conditions of the North Vietnamese people. North Vietnamese morale has been most damaged by the evacuation of non-essential persons from urban areas because the North Vietnamese have a strong sense of family. An estimated 50 percent of the population of Hanoi and 75 percent of that of Haiphong have been evacuated. It is probable that within six months most evacuated persons would have returned to urban areas. Other hardships, including interruption of normal work routines, personal injuries, loss of life, property damage, and the constant threat of bombing, would also be alleviated by a bombing halt.

II. Impact on Logistics

A. Present Status of the Transport System

Despite the bombings the capability of North Vietnam's transport system remains adequate to meet the country's economic and wartime requirements, and in several important areas capacity has been substantially increased by the construction of new facilities and improvements to the old. Continuous air attacks over the past three years have destroyed key bridges, disrupted traffic, and destroyed large amounts of transport equipment, but the transport system continues to function with the assistance of numerous bypass facilities, extensive transshipments, night operations, importation of transport equipment, and the expenditure of substantial amounts of labor and material on repairs and countermeasures. Transport in the Hanoi and Haiphong areas has been hindered by damage to key bridges, but a number of rail and highway bypasses and the use of watercraft provide capacity far in excess of that available before the bombing. Through rail service from Hanoi south to Vinh has usually been impossible, but shuttle traffic continues. Highway traffic south of Hanoi is continually disrupted by the bombing, but large truck movements continue. The capacity of the transport routes is well in excess of the relatively small volume of goods required from North Vietnam to support the war in the south.

B. Repair and Reconstruction

A bombing halt would result in a concerted effort to restore key rail and highway routes to full service. The most important aspect of these repairs would be the reconstruction of major bridges, including the Haiphong Railroad/Highway Bridge (only recently repaired), rail and highway bridges at Hai Duong and Ngoc Kuyet, and the Hanoi Railroad/Highway (Doumer) Bridge over the Red River. In addition, several important rail facilities would be repaired on the Hanoi-Vinh rail line and on the Hanoi-Dong Dang line.

The first priority would be the improvement of through rail service to and from Haiphong. Preliminary analysis of [redacted] photography reveals that the North Vietnamese have already taken advantage of the limited bombing halt to restore the main rail bridge at Haiphong. Imports can now move directly from Haiphong by rail, lessening the need for trucks in the area. Further west, restoration of damaged rail/highway bridges at Hai Duong and Ngoc Kuyet and the reconstruction of the Doumer Bridge would permit improved through rail service from Haiphong to Hanoi. 25X1

The second priority would be the restoration of the rail and highway LOC's leading south of Hanoi to Vinh -- the heavily damaged Hanoi-Vinh rail line and highway Routes 1A, 15, 7, and 137. Through rail service to Vinh has been hindered by damaged bridges, although movement of rail traffic has continued by shuttling rail cars between interdicted points. Restoring through rail service to Vinh would greatly improve North Vietnam's capability to move goods into the Panhandle for storage or for further distribution into Laos or South Vietnam.

The third priority would be the repair of rail bridges and yards along the Hanoi-Dong Dang line, the principal rail connection to Communist China and the route over which most overland imports are moved.

During the early months of a bombing halt, construction crews would probably make only temporary repairs of rail and highway LOC's, relying mainly on materials available locally such as timber, stone, and bamboo; but if the bombing halt were extensive, permanent repairs and expansions of capacity could be accomplished in about two years. Temporary crossings could eventually be replaced with steel and concrete bridges. Some bridges, such as the Doumer Bridge, probably would be completely rebuilt because of extensive bomb damage. The rail network could be completely

converted to dual or standard gauge. This would require the reconstruction of many major bridges that would not be adequate to carry heavier standard gauge equipment.

The primary restoration work required on the waterway system would be the removal of latent MK-36 mines sown in key waterway locations. Mined areas could be cleared shortly after a bombing halt by towing metal-laden rafts over areas in which the magnetically sensitive MK-36's have been sown. The waterway system has been intensively bombed, but the flexibility and primitive nature of the system have minimized bomb damage. Restoration of damaged port facilities in the south would eventually be undertaken, however.

C. Logistics Flows Through North Vietnam

A complete cessation of the bombing of North Vietnam would result in an increase in the volume of military supplies, petroleum, and military related economic goods being moved into and through the North Vietnamese Panhandle. The Panhandle of North Vietnam would become even more important as a rear staging area for the war in South Vietnam. The number of storage sites, truck parks, petroleum storage areas, repair sites, and distribution centers probably would be increased. The initial increase in logistics activity would not be due to a lifting of a "ceiling" on the volume of traffic that had been imposed by bombing -- bombing has had little limiting effect on traffic flows in the past -- but would be due to a desire to take advantage of what may be a short-lived opportunity to move traffic with a minimum of cost and effort. After the first surge to improve stockpiles and resupply units in southern North Vietnam, Laos, and South Vietnam, the flow of supplies would depend on Hanoi's future intentions and the course of the war in South Vietnam.

III. Impact on the Military

A. Air Defense Systems

During the first six months after a cessation of Rolling Thunder and the bombing in Laos, some redeployment of aircraft and antiaircraft artillery could take place, but there would be no demobilization of North Vietnamese air defense forces. Damage to important airfields would be repaired, and some aircraft currently in China probably would be returned. A few MIG's might be relocated to an airfield near Vinh and later to an airfield near Bai Thuong now under construction in order to oppose Allied aircraft operating over northern South Vietnam. Much of the aircraft inventory probably would remain in China, however, in anticipation of a possible resumption of the air war and attacks against airfields.

Despite the heavy damage inflicted under the Rolling Thunder program, the North Vietnamese air defense system has been expanded and made more effective since the start of the bombings. Destruction of jet fighters has been particularly heavy, but replacements from the USSR and China have been sufficient to maintain the inventory at a relatively constant level since 1965. The attacks have forced North Vietnam to hold about 80 to 90 percent of the inventory in reserve in China, but a small effective force of 10 to 20 MIG's continues to stage out of North Vietnamese airfields. Damage to airfields has been repaired in relatively short periods of time and work continues on new airfields. The capabilities of both the ground-control intercept and early-warning radar networks have been increased by infusions of more sophisticated equipment and by improved operator efficiency. Although airstrikes have necessitated frequent redeployment of SAM equipment, which probably has reduced the efficiency of the firing units and has complicated logistics, the North Vietnamese now have up to 30 SAM firing battalions, and new SAM sites are being built throughout the country.

As many as 1,500 antiaircraft weapons, about 15 percent of the total installed in North Vietnam, could be redeployed to South Vietnam without seriously impairing North Vietnam's air

defense capability. About 60 percent of these could be 37-mm weapons or larger.

Significant changes in the North Vietnamese air defense system over a two-year span would depend on the North Vietnamese evaluation of the likelihood that air attacks would not be resumed.

B. Military Equipment Imports

During the first few months of a bombing pause, imports of military materiel probably would be maintained at current levels in order to build up stockpiles, but during an extended bombing halt, the import of air defense materiel could be drastically reduced since ammunition expenditures and equipment damage would be minimal. The current value of air defense related imports -- missiles, aircraft, AAA ammunition, and other materials -- may be as much as $530 million per year. The emphasis of military imports could be shifted from air defense equipment to infantry weapons, and the heavy dependence on the USSR for military aid could be reduced substantially because the USSR is the chief donor of air defense equipment and supplies.

Almost all of the military materiel used by North Vietnam must be imported from other Communist countries. Since the bombing began, the USSR and Communist China have expanded their military aid to North Vietnam from an estimated $270 million in 1965 to about $660 million in 1967. The USSR has concentrated on air defense equipment including surface-to-air missiles, antiaircraft guns, radar, and fighter aircraft, including MIG-21's. Chinese military aid has concentrated on building up North Vietnamese ground forces and sustaining the military effort in South Vietnam. In addition, China apparently has supplied radar and MIG-17/19 aircraft. During 1967 the European Communist countries supplied small amounts of military related goods and some weapons.

C. Military Manpower

Under a bombing halt, military manpower availability would probably not be changed

appreciably and the size of the North Vietnamese military establishment probably would not be altered. As long as the danger of an invasion or a resumption of the bombing exists and North Vietnam continues to supply manpower for the war in the south, it is unlikely that Hanoi would reduce military force levels (built up since 1965 from 240,000 to about 480,000). North Vietnamese air defense forces in the Laotian Panhandle probably would be kept in place as security for the lines of communication. About 6,000 air defense troops, however, could be freed for similar duty in South Vietnam without weakening North Vietnam's air defense. Of the North Vietnamese in-country ground forces, an estimated 50,000 are presently available to send to South Vietnam, irrespective of the level of bombing. In addition, more than 100,000 new recruits each year are available to augment or replace out-of-country forces.

IV. Effects in Laos

A bombing halt in the Laotian Panhandle would make the movement of men and equipment into South Vietnam easier, but it would not necessarily result in a greatly increased flow of personnel and supplies. The level of military tonnages and personnel that could be moved through Laos by truck would increase the danger of an invasion of South Vietnam by a conventional large-scale military force. The Communists could with increased speed mass forces and supplies in four general areas of southern Laos -- opposite South Vietnam's Quang Tri, Thua Thien, Quang Tin, and Kontum Provinces. Bombing has not previously limited the flow of men and supplies in Laos, however, and traffic through Laos is and would be determined more by Hanoi's intentions in South Vietnam and Hanoi's estimate of what the United States would tolerate before resuming air attacks.

The Communists probably would continue to extend border crossing roads into South Vietnam, upgrade river crossings, and improve existing roads and their all-weather capability. There would be little expansion of the road network in Laos beyond that currently under way, however, because the network presently is adequate for any foreseeable Communist requirement.

The efficiency of truck operations would be vastly improved by an increase in daylight operations and by elimination of the need for camouflage and evasive action. Much larger tonnages of logistic support and larger numbers of personnel could be moved into or through Laos with no increase in the truck inventory.

Infiltration casualties and equipment losses would be eliminated. About 20 percent of the equipment and supplies transiting Laos are currently assumed to be lost from all causes while en route to South Vietnam.

During an extended bombing halt, after reconstruction and repairs of bomb damage were completed, the requirement for manpower would be reduced. In the long run, about one-third, or 10,000, of the North Vietnamese used to maintain and protect infiltration routes could be made available for service in South Vietnam or could be returned to North Vietnam.

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Foreword

The primary yardstick by which the effectiveness of any bombing program against North Vietnam is measured is the consequences which the neutralization of the chosen group of targets has or will have on Hanoi's ability to sustain Communist military operations in South Vietnam. The consequences of any bombing campaign, however, are limited by the nature of North Vietnam's contribution to the fighting in the south. North Vietnam essentially serves only two purposes:

a. as a source of manpower, and

b. as a logistics funnel.

Therefore, those economic activities which are normally found to be lucrative targets for bombing campaigns, namely, the industrial war-supporting sinews of a nation, are essentially not present in North Vietnam. They lie in the Soviet Union and Communist China, who not only furnish the munitions, petroleum, and other supplies needed by the VC/NVA forces, but also stand ready to make up deficits in the civilian economy, such as shortfalls in crop production.

Potential effects of attacks on North Vietnamese target systems, therefore, are necessarily somewhat circumscribed by these circumstances.

CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
12 April 1968

INTELLIGENCE MEMORANDUM

POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(The Case Where All Except Approximately Five Percent of the Attack and Armed Reconnaissance Sorties in North Vietnam Are in Route Packages I, II, and III). (No. 7)

Summary

This paper analyzes the anticipated effects of a Rolling Thunder program that allocated all but about 5 percent of attack and armed reconnaissance sorties in North Vietnam against Route Packages I, II, and III. This area is one which has borne the brunt of the Rolling Thunder campaign over the past three years. The proposed change could raise the monthly attack sortie rate from the 1967 level of 6,000 to about 8,000, or approximately 40 percent. Route Packages I, II, and III encompass an industrially unimportant, sparsely populated area, whose value is as a logistics funnel to supply VC/NVA forces in Laos and South Vietnam. We believe proposed concentration of the bombing effort against North Vietnam on the three southernmost areas would have the following direct effects:

1. In the short run, it would complicate the problems of supplying

Note: This memorandum was produced solely by CIA. It was prepared by the Office of Economic Research and was coordinated with the Office of Current Intelligence and the Director's Special Assistant for Vietnamese Affairs.

the local population, but would be unlikely to have more than a very temporary effect on the flow of men and supplies to South Vietnam. The routes leading from the route packages into Laos and the DMZ are utilized to only about 15 percent of their capacity. Within a week to 10 days, Hanoi could shift the necessary repair crews from the northern areas to cope with the higher levels of damage. The demonstrated capability of the North Vietnamese to mobilize quickly the needed men (about 15,000 in this case) and materials to repair damaged key transport points and construct alternative bypasses means that any effects on the flow of essential materiel would be highly limited in time.

2. Added losses of trucks and railroad rolling stock could be supplied easily by other Communist nations, primarily the USSR and Communist China. These nations have demonstrated an ability to respond rapidly to Hanoi's needs for such equipment.

3. Over time, Hanoi would probably shift some of its surface-to-air missile systems and AAA guns to the southern route packages. This shift could raise the present very low loss rate of 1.2 US attack aircraft per 1,000 sorties over Route Packages I, II, and III to a level closer to the general average for North Vietnam. About 16,000 additional troops would have to be added to the North Vietnamese forces if Hanoi succeeded in securing replacement air defense equipment from the USSR and Communist China to redeploy in the northern areas.

Since the redirected Rolling Thunder program would have no direct effect -- apart from some highly temporary disruption -- on Hanoi's capability to sustain the war in South Vietnam by continuing the infiltration of men and materiel, it is most unlikely that there would be any direct effect on the will of the regime to continue the war.

The international reaction to confining the bombing campaign to Route Packages I, II, and III would probably be favorable, since the attacks would avoid the populated areas of North Vietnam and would be confined to areas which are infiltration funnels to Laos and South Vietnam.

It is unlikely the proposed shift in the bombing program would have any significant effect on Hanoi's present position on negotiations with the US. The North Vietnamese have to date offered to meet with US officials only for the purpose of discussing a complete cessation of the bombing.

I. Air Operations

A. Previous Attacks Over Route Packages I, II, and III

Since the beginning of the Rolling Thunder program, Route Packages I, II, and III have borne the brunt of the US air attacks. Almost 80 percent of all attack sorties flown in North Vietnam during 1966 were against targets in these route packages. In 1967 the increased emphasis on targets in the Hanoi and Haiphong areas and on points on the lines of communication (LOC's) in the Northeast brought the share of attacks on the three southern route packages down to about two-thirds. However, because of the increased intensity of the bombing program last year, the average number of attack sorties flown per quarter over Route Packages I, II, and III increased from about 16,200 in 1966 to 17,900 in 1967. Sortie levels have been consistently highest in the third quarter, when the best flying weather prevails, and lowest in the first and fourth quarters in the face of poor weather. Attack sorties over Route Packages I, II, and III during 1966, 1967, and 1968 are given by quarter in the following tabulation:

	1966	1967	1968
January-March	6,500	15,430	11,130
April-June	14,900	22,180	
July-September	26,500	20,220	
October-December	16,650	13,960	
Total	*64,550*	*71,790*	*N.A.*

During 1967, about 140,000 tons of ordnance was dropped on targets in Route Packages I, II, and III, an increase of about 60 percent over 1966. B-52 aircraft delivered about 30 percent of this tonnage, largely against tactical military targets. Of the total delivered by B-52's, approximately 70 percent

was against military targets, nearly 14 percent against storage and supply areas, and the remainder against infiltration and logistics targets, such as roads, truck parks, and staging areas. The B-52 attacks were heavily concentrated in the area immediately north of the DMZ and areas close to the Mu Gia Pass. The 98,000 tons of ordnance delivered by attack aircraft other than the B-52's was targeted largely against infiltration and logistics targets -- bridges, vehicles, storage areas, transshipment points, and watercraft.

The US aircraft loss rates sustained over Route Packages I, II, and III have consistently been the lowest of the war because enemy air defenses have been relatively weaker in the southern than in the northern route packages. Slightly more than one-third of all Rolling Thunder combat losses have been sustained in Route Packages I, II, and III, despite the large share of total attacks flown against these areas. During the last three quarters -- July 1967-March 1968 -- 76 aircraft were downed by Communist defenses in these areas while participating in a total of 65,300 attack and support sorties -- a loss rate of 1.2 aircraft per 1,000 sorties. By comparison, the loss rate of attack and support aircraft throughout North Vietnam during the same period was 2.0 per 1,000 attack and support sorties. The comparable loss rate over Route Package VI was 4.3 -- three and a half times greater. Losses and corresponding loss rates of attack and support aircraft in Route Packages I, II, and III are given by quarter in the following tabulation:

	Aircraft Losses				
	Route Packages				
1967	I	II	III	Total	Loss Rate [a]
January-March	13	0	10	23	1.0
April-June	15	3	11	29	1.0
July-September	30	5	3	38	1.4
October-December	17	1	4	22	1.0
1968					
January-March	9	5	2	16	1.0

a. Losses of attack and support aircraft per 1,000 attack and support sorties. Loss rates for the first two quarters of 1967 are estimated.

B. Stepped-up Attacks Against Route Packages I, II, and III

Assigning all but 5 percent of the Rolling Thunder sorties to strikes against Route Packages I, II, and III (assuming the same level of attacks against North Vietnam as in 1967) would make available almost 30,000 more sorties than were targeted against the three southern route packages last year. This would raise the monthly attack sortie rate to almost 8,000, compared with 6,500 in 1967 in this area. Such a shift in geographic coverage could increase by 42 percent the level of attack in this area. Weather constraints, however, suggest that the additional sorties available might have to be divided between targets in Laos and the three southern route packages, so that the number of sorties available for attacks against Route Packages I, II, and III would represent a 25-percent increase over 1967. If it is desired to achieve a 40-percent increase in southern North Vietnam, this could be done by diversions of aircraft from targets in Laos.

Poor weather restricts the level of attack in North Vietnam and in Laos during alternate halves of the year. The best weather for air operations over the panhandle of North Vietnam normally extends from mid-May to mid-September, corresponding to the poorest flying weather in Laos. The best weather for air operations in Laos extends from mid-October to mid-March when attacks are sharply reduced in North Vietnam. Parts of September, October, March, May and all of April are transition periods when the weather is fair for attack over both areas. By the use of radar systems runs, attack sorties are flown in the southern route packages throughout the year. The limited number of aircraft equipped with the needed radar systems, however, suggests that the level of attack sorties in the sourthern area probably would not be increased during the poor flying weather.

During 1967 the total of 117,950 attack sorties flown against Laos and the North Vietnamese panhandle were distributed 61 percent in North Vietnam and 39 percent in Laos. If this 60-40 ratio is used to distribute the 30,000 additional

attack sorties, a one-quarter increase in attack sorties could be achieved in both Laos and the North Vietnamese panhandle. About one-half of the additional attack sorties over each area could be flown in the good weather season, about one-quarter in each of the fair weather seasons, and none in the poor season. Attack sorties flown per month during 1967 for each weather season are shown in the following tabulation:

	Route Packages I, II, and III		Laos	
Season	Weather	Attack Sorties per Month	Weather	Attack Sorties per Month
Spring transition- (Mid-March to Mid-May)	Fair	6,870	Fair	4,260
Southwest monsoon- (Mid-May to Mid-September)	Good	8,050	Poor	1,390
Autumn transition- (Mid-September to Mid-October)	Fair	5,310	Fair	2,020
Northeast monsoon- (Mid-October to Mid-March)	Poor	4,110	Good	6,010

C. Limited Attacks in Route Packages IV, V, and VI

Assuming the 1967 level of sorties but limiting attacks against targets in Route Packages IV, V, and VI to 5 percent of total Rolling Thunder sorties results in only 5,300 sorties being available for targeting against the northern route packages, compared with 35,000 last year.

The reduced number of sorties, if judiciously targeted, could have, however, a significant impact on some aspects of the North Vietnamese economy and

military posture. During 1967 the number of sorties flown against some target systems in the three northern route packages was not large. About 1,030 attack sorties were flown against industrial targets. As few as a quarter of this number of attacks probably would prevent any major restoration of electric power and industrial production. Something less than 1,600 sorties were directed at airfields in the northern area and about 1,600 against radar systems. In 1967, only 290 attack sorties were made against the key Doumer and Canal des Rapides bridges in the Hanoi area, and about 4,000 sorties were flown against industrial, military, and logistics targets in the entire Hanoi/Haiphong area.

It would not be possible, however, to maintain a significant interdiction effort against the main LOC's throughout the northeast. Between 9,000 and 10,000 sorties were flown against rail lines in the northern route packages in 1967, and at least as many against highways and waterways together. About 3,000 attack sorties were flown against the key Hanoi-Dong Dang rail line alone.

II. Importance of Route Packages I, II, and III

The importance of Route Packages I, II, and III stems mainly from their strategic location astride the logistical pipeline to southern Laos and South Vietnam. Men and supplies from North Vietnam sent to support the war in the south must transit all or part of these three route packages. Although poor in resources, the area supplies manpower and local construction materials for repair of these critical LOC's.

The three route packages are of only slight economic importance. They contain less than 15 percent of the population and 20 percent of the land area of North Vietnam, about equal to the area of Connecticut and Massachusetts combined. There are no identified mineral resources and much of the region is mountainous, forested, and sparsely populated. The population of the area is predominantly rural; only four communities have more than 4,000 -- Vinh, Dong Hoi, Vinh Linh, and Ha Tinh. Agriculture and fishing are the principal occupations. Rice and other foods are grown in all three route package areas, but only Route Package III is self-sufficient in food production. There are a few minor industrial plants in the Vinh area, including an electric generating plant and a small machine plant (both rendered inoperative by the bombing), a small cement and concrete products plant, and a sugar mill. A few other small industrial facilities are scattered throughout the area. With no ports capable of receiving foreign imports directly, Route Packages I, II, and III depend on supplies from the north for almost all of their manufactured goods, including spare parts and materials for repair of transport equipment. In addition, Route Packages I and II import a small part of their food needs from the rest of the country.

III. The Logistic System

A. Transportation Facilities

The road system constitutes the most important form of transport in Route Packages I, II, and III, although other forms of transport -- rail, tramway, and waterway -- supplement the roads and add to the total capacity and flexibility of the logistic system. Distances are short; the northeast corner of Route Package III to the Mu Gia Pass is about 125 miles and the northern border of the area to the DMZ is about 200 miles (see the map). Total capacity of the transport system in these route packages is far in excess of both the tonnages that move to support the military and economic requirements of Route Packages I, II, and III, and the tonnages of military supplies that are funnelled through the region to Laos, the DMZ, and South Vietnam.

1. Highways

Two roads of moderate capacity -- Route 15 and Route 1A -- support most of the through movement in the area. These two routes have a combined capacity of 2,100/500 tons* each way per day near the northern border of Route Package III. The capacities of the highways

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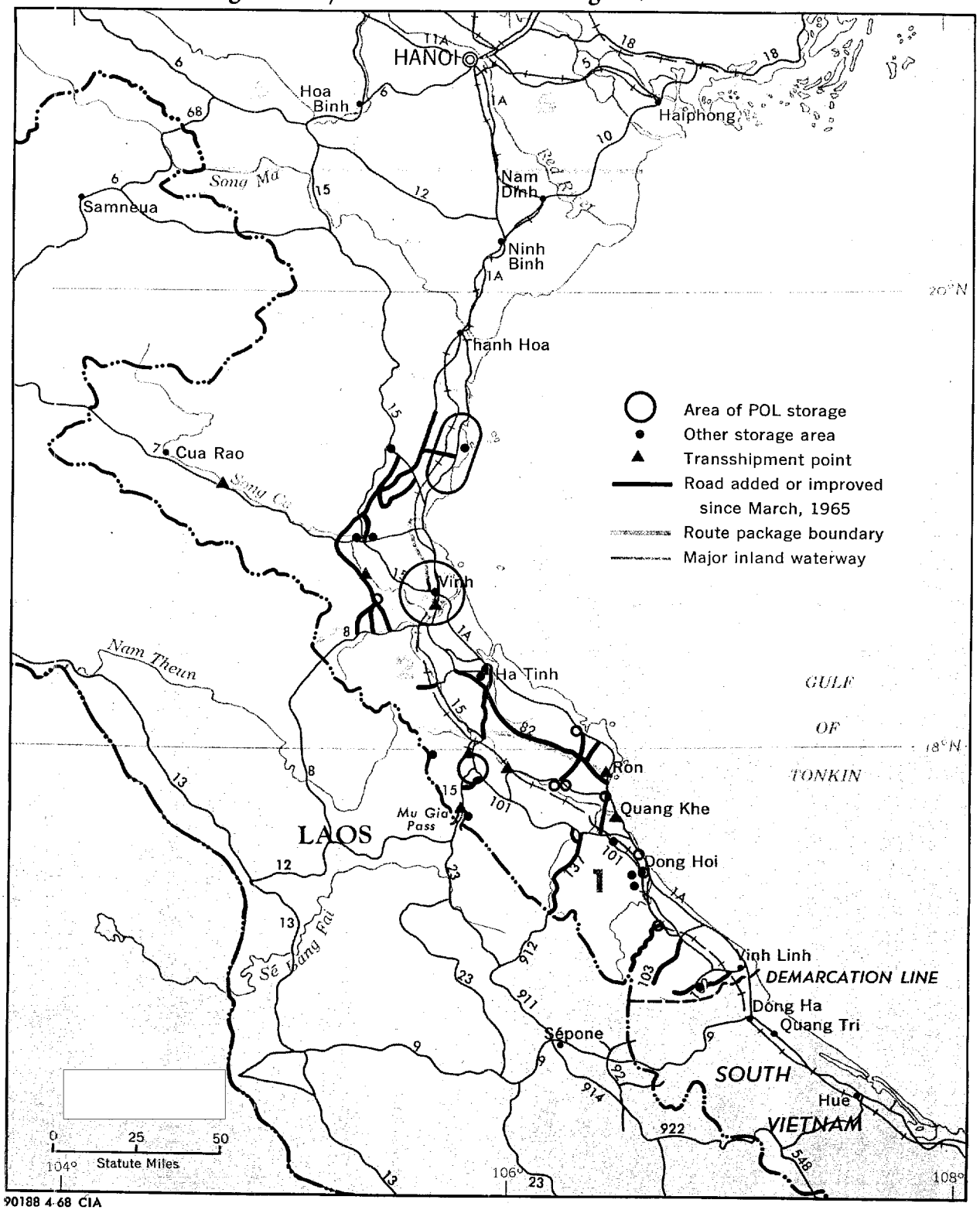
* *The first figure (2,100) denotes dry season capacity during about nine months of the most favorable weather, and the second figure (500) denotes the wet season capacity during three months of heavy rainfall. Heavy rains begin sometime between August and October, depending on the location in the southern part of North Vietnam, and extend for about three months. Capacity figures given are estimated theoretical capacity. Photography of truck activity in this area, especially during the recent holiday truce periods which occurred during the wet season, indicate that the roads -- especially Route 1A -- can accommodate levels of movement in excess of the estimated capacity.*

North Vietnam: Logistical Systems in Route Packages 1, 2 & 3



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within the southern route packages, and the capacities of the roads exiting into Laos and the DMZ are both in excess of the capacities of the two roads leading into the route packages, giving the highway system within the area excess capacity to counteract the results of air attacks.

Road distances are not great. Truck traffic flows into Route Package III primarily by Route 1A, but also by Route 15, and continues southward 39 and 69 miles, respectively, to the Vinh and Ha Tinh areas. Truck movements southward from Vinh and Ha Tinh generally move either to Laos (via Routes 7, 15, and 137), a distance of about 120 miles, or to the Dong Hoi and DMZ area (via Route 1A and 101), a distance of about 140 miles.

2. Railroads

Rail service into the area moves on the 68-mile Thanh Hoa - Vinh segment of the 200-mile Hanoi - Vinh line. The line has an uninterdicted capacity of 2,200 tons each way per day, but through service is usually impossible because of bombings, although shuttle traffic continues. The yard at Thanh Hoa, just north of the northern boundary of Route Package III, serves as a major distribution center for the movement of supplies south to Vinh. Before the bombing, trains negotiated the run between Thanh Hoa and Vinh in six hours, but movement is much more difficult and time consuming today. Despite the heavy bombing, however, traffic continues on the line. At Vinh, freight is transshipped from the main railroad line to trucks or inland watercraft and some of it is moved to Xom Khe for further shipment on a tramway.

In addition to the main railroad line, there is a rail tramway which extends from Xom Khe, 30 miles south of Vinh, to Dong Tam, a distance of 47 miles. The estimated uninterdicted capacity of the tramway is about 500 tons each way per day. The tramway is used by small meter-gauge cars hauled by motor trucks with flanged wheels and

is generally not used to any great extent, but some movement has been observed during truce periods.

3. Waterways

The use of water transport is limited by geography and US naval and air action, but a substantial amount of goods continue to move over inland and coastal waters. The inland waterways within the region do not provide a through route for the movement of traffic south to the DMZ or west to the Laotian border. Locally, however, inland watercraft are used extensively to support overland transport. Sampans, ferries, junks, rafts, and canoes are widely used to ferry goods across interdicted LOC's. They also perform a significant part in the distribution and dispersal of supplies away from the important transshipment areas. Coastal routes are almost exclusively restricted to use by barges, junks, and other similar craft. These craft are unloaded at makeshift transshipment areas into trucks for movement by road or sometimes into other watercraft for further movement on the inland waterways. By hugging the coast and moving at night, this coastal traffic is able to continue, although at a reduced level, in spite of US naval operations. The use of larger craft has been made difficult by both naval patrols and Rolling Thunder bombings of port facilities.

4. Primitive Transport

Primitive means of transport such as cargo-carrying bicycles also perform a significant role in moving goods through the southern route packages. The North Vietnamese have imported thousands of specially designed bicycles, capable of carrying about 500 pounds each. Twelve such bicycles have the carrying capacity of one three-ton cargo truck. These bicycles, together with coolies, elephants, and water buffaloes, have been often reported transporting supplies in the more remote areas.

5. Storage Facilities

Although Route Packages I, II, and III are closer to the fighting fronts than other areas of North Vietnam, less than one-half of the more than 700 identified supply, storage, and transshipment areas in North Vietnam are located in these areas. Only about 8 percent of the storage capacity for military supplies in this area originally on the JCS target list remains active. The destruction of military stores in this region by the Rolling Thunder program has been considerable and almost all supplies maintained in these route packages are now stored in small, dispersed sites.

B. Operation of the System

The North Vietnamese logistical system is well organized and adequately maintained. Military shipments are under control of the Rear Services Headquarters near Hanoi. Economic shipments are controlled at the province and district levels. Liaison is maintained between the military and civilian transport authorities at nearly every level so that the best use can be made of the scarce transport resources and that vital traffic can be maintained.

To counter the effects of the Rolling Thunder program against the LOC's in Route Packages I, II, and III, the North Vietnamese have employed numerous techniques to insure the continued through shipment of necessary material. Most transport operations are conducted only during hours of darkness, or under the cover of poor weather. Elaborate traffic control systems, staffed by the local population, have been established to expedite the flow of traffic and warn of impending air attack. In addition, the major storage, dispersal, and transshipment centers have been strategically located in the large populated areas exempt from the bombing. These centers, principally Thanh Hoa, Vinh, and Ha Tinh, are all at the junction of major supply routes. Trucks can make round-trips between

them under cover of darkness (see the tabulation below). South of Ha Tinh, logistic supplies are widely dispersed along the infiltration routes leading into Laos and the DMZ.

Area	Distance	Estimated Turnaround* Time (Hours)
Thanh Hoa - Vinh	62	9
Vinh - Ha Tinh	30	6

* *At an average speed, 20 miles per hour, and including three hours for loading and unloading.*

C. Traffic Flows

The North Vietnamese have continually increased the volume of supplies moved south through the three southern route packages. The total daily volume moved south into Route Package III in 1967 was about 770 tons, more than double the volume of 1965. Large increases occurred in late 1965 and in 1966 as countermeasures to the bombing became more effective and the insurgency in South Vietnam increased in intensity. The increase in 1967 over 1966 was quite small, possibly only about 10 percent, but thus far in 1968 there has been a further increase in the volume moved into Route Package III. This increase is mainly the result of the step-up in personnel infiltration into South Vietnam, logistic support for the war in South Vietnam, and the increase in Communist troop strength and activity in Laos.

About one-third of the total flow into Route Package III is strictly economic goods, and the other two-thirds are military supplies and military-related economic goods such as petroleum. About 80 percent of the volume that moves into Route Package III is used in the three southern route packages and in the DMZ area, about 15 percent is moved into southern Laos for use

there or in South Vietnam, and the remainder is moved west on Route 7 into northern Laos to support Communist troops and civic action programs in the Plaine des Jarres area.

The above estimates, however, are based on indirect evidence, rather than on firm intelligence. The estimates are derived from Communist military requirements in the DMZ; military and economic requirements in Route Packages I, II, and III; traffic movements reported by US pilots flying over the area; and reports by road watch teams of traffic moving into Laos.

Road watch reports indicate that the average daily volume of goods delivered into southern Laos has increased markedly, as shown in the tabulation below. The volume delivered into Southern Laos in the first quarter of this year has been more than 60 percent greater than the same period last year. If this trend continues, the average volume delivered during 1968 will be about 160 tons per day. This tonnage is sufficient to meet current requirements in Laos, to satisfy the external supply requirements of the Communist forces currently in South Vietnam, and to support further augmentation of these forces by four divisions.

	Short Tons per Day	Percent Increase over Previous Years
1965	35	
1966	75	114
1967	95	27

The volume of traffic flowing into the three southern route packages is small in relation to transport capacity. Compared with about 850 tons a day moving south into Route Package III during the first quarter of 1968, truck routes had 2,100/500 tons of uninterdicted capacity, with a railroad as well as inland and

coastal water routes available to provide additional transport capacity. Furthermore, the volume of tonnage moving within Route Package III rapidly diminishes as the supplies are moved south, and the total capacity of the transport system decreases less rapidly than the decrease in traffic. Routes leading into Laos are used on the average at less than 15 percent of their capacity.

Route Packages I, II, and III have also been heavily used for the infiltration of North Vietnamese troops to South Vietnam. MACV's estimate of total infiltration, accepted and possible, from October 1965 through February 1968, totals 203,500. In the first quarter of this year the North Vietnamese may have mounted the largest infiltration effort they have ever undertaken. Total infiltration to South Vietnam for the first three months of 1968 may have reached 40,000 to 50,000 men. The speed with which some infiltrators have reached South Vietnam tends to confirm earlier indications that some of the troops are being moved by truck despite the US air interdiction campaign.

IV. Probable Effects of Escalated US Air Attacks

The record of the Rolling Thunder program against Route Packages I, II, and III during the previous three years of bombing indicates that even escalated attacks against these route packages will not have a significant impact on the area's transportation system. Throughout the past three years, all highways, waterways, and rail facilities in the area have been attacked repeatedly, as well as fords, ferries, pontoon bridges, transportation equipment, truck parks, and storage and supply areas. Despite the high level of attacks which have hampered some operations, the transport network continues to function, and the North Vietnamese have organized substantial repair forces to cope with the damage. The network provides adequate service and capacity to meet North Vietnam's logistic requirements in the area and to the South.

A. Railroads

The rail line between Thanh Hoa and Vinh, the tramway south of Vinh, and the rail yards at Vinh and Thanh Hoa have been attacked and damaged repeatedly during the three-year bombing campaign, but quick repairs and emergency arrangements have allowed goods to continue to move by rail. In 1967, about 3,500 sorties were directed against these targets, nearly one-half the total directed against the entire Hanoi-Vinh line. The intensity of attack against the rail line over the past three years has prevented through service to Vinh and has limited the line's capacity by causing a shift of some traffic from the conventional meter-gauge rail equipment to the smaller tram cars because of line and bridge limits south of Thanh Hoa. Despite the heavy damage inflicted by the bombing, operations between interdicted points have continued. Various alternate facilities constructed around bridges and yards and quick repairs have contributed to the overall flexibility of the system. Most movement occurs at night, when attacks are less effective against supplies being moved.

B. Highway System

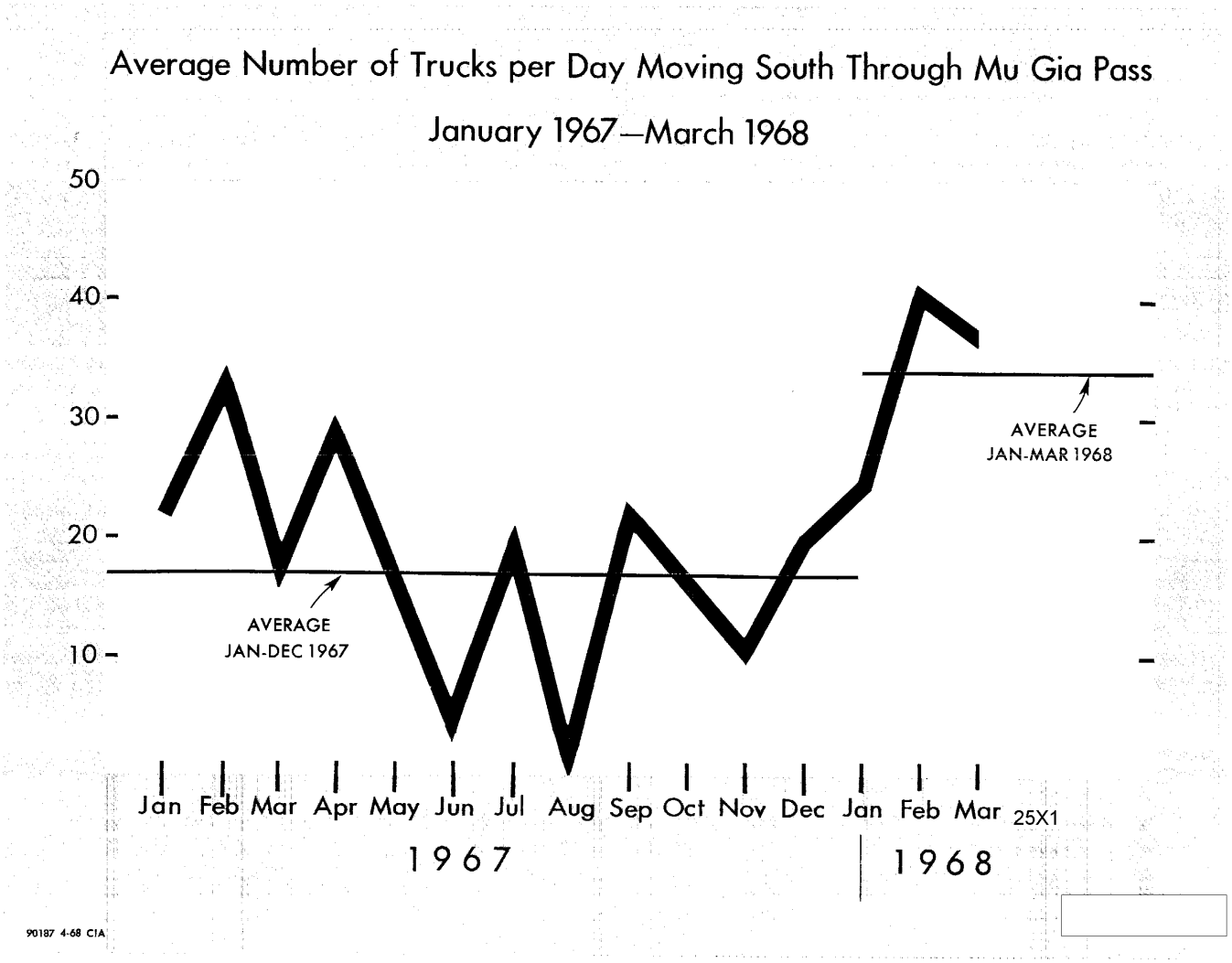
Air attacks against the highway system in Route Packages I, II, and III over the last three years have not sustained the interdiction of highway operations. The heaviest attacks of the entire Rolling Thunder program have been concentrated against highway targets located in the three southern route packages, with Routes 1A, 15, 7, and 101 receiving the greatest damage. Although these strikes have interrupted and impeded traffic, repair efforts and countermeasures have been effective in maintaining traffic flows throughout the system.

Despite the bombings, the overall capacity of the road network in Route Packages I, II, and III has been increased. Two major roads -- Routes 101 and 137 -- have been built and several secondary roads improved since the start of the bombing campaign in 1965. Route 101, completed in 1966 and more than 200 miles in length, was built to serve as a less vulnerable north-south inland alternate to coastal Route 1A. Route 137 was built to provide an additional road into Laos. This route connects the important Quang Khe transshipment area to Route 911 in Laos (26 miles). A new, well-built road extending from the Dong Hoi area toward the southwestern corner of the DMZ (16 miles) is well under construction and is now only two miles from the Laotian border.

An increase in sortie rates would probably have little effect on truck traffic. A comparison of truck traffic observed moving into southern Laos through Mu Gia Pass (see the chart) by months in 1967 and 1968 with the sortie rate over Laos and North Vietnam in the area of the Pass shows no obvious correlation, either direct or inverse. In some months, both sortie rate and truck traffic increased or decreased together, whereas in other months one factor increased and the other decreased.

C. Waterways

Attacks against water routes in Route Packages I, II, and III have hampered waterborne transport, but traffic continues to move.



The coastal ports in Route Packages I, II, and III have been heavily damaged but are still in partial use. Wharf areas have been damaged, berthing blocked by sunken vessels, and nearly all storage space has been extensively damaged or destroyed. The small port and transshipment facility at Quang Khe is probably the most heavily attacked target in North Vietnam. However, numerous small craft, such as sampans, still operate at these port facilities and transit rivers on which the ports are located.

Operation Sea Dragon, a US Navy surveillance and interdiction operation of North Vietnam military and logistic targets along the North Vietnamese coast south of 20° North latitude, supplements the Rolling Thunder program in the southern route packages and has denied the use of coastal waters to large North Vietnamese ships, but some coastal traffic continues to move. One cruiser and four destroyers are normally maintained on station patrolling these coastal waters. Since the operation was begun in October 1966, it has reportedly destroyed about 1,000 craft and damaged another 1,300. The operation appears successful in prohibiting large coastal vessels from operating in these southern coastal waters.

The mining program using the MK-36 Destructor weapon has been in effect against the waterway system since June 1967, but the overall performance of the weapons has been uneven and has not denied the North Vietnamese the use of important waterways. About 10,000 MK-36's have been employed in the three southern route packages. Targets that have been heavily seeded with Destructors continue to be used. An example is the Kien Giang River, near Dong Hoi, in Route Package I. From 1 December 1967 to 31 March 1968, a total of 1,783 MK-36 devices were seeded from the mouth of this river to about 10 nautical miles upstream, but most waterway and transshipment facilities were still operational.

The planned increase in seedings of the MK-36 may increase the effectiveness of the mining program. It is anticipated that by June of 1968,

13,000 devices per month will be available and the level of seedings will reach this level soon afterwards. The total amount of weapons deployed in the June 1967 - 31 March 1968 period was 19,500. Of this total, 10,000 have been dropped in Route Packages I, II, and III. Thus the anticipated increase in weapons deployed is from 19,500 in a ten-month period to a level of 13,000 per month. The planned rate of increase, therefore, is quite rapid and it is difficult to estimate final results this early in the program.

D. Bridges

Much of the bombing activity against the transportation system in Route Packages I, II, and III has been directed against key bridges along the major land routes. Through 1967, 285 such bridges had been repeatedly attacked and damaged in the southern route packages, compared with 404 bridges attacked in all of North Vietnam. Although these strikes have interrupted and impeded traffic, repair efforts and countermeasures have been effective in maintaining traffic flows throughout the system.

The North Vietnamese should be able to counter an increased level of bombing of bridges in Route Packages I, II, and III. The North Vietnamese have already built an average of 1.42 alternate facilities or bypasses -- pontoon bridges, cable bridges, ferries, and fords -- per bridge in the south. Although there are more water crossings in the south than in the north, they are less formidable to bypass. For example, the water crossings in the south are not as wide or as deep as the streams in the Red River Delta. Moreover, in Route Packages I, II, and III, river-crossing targets will be principally those associated with truck movements, and it is easier and cheaper to repair such facilities than railroad bridges. A relatively small additional diversion of the North Vietnamese labor force would be able to make necessary repairs and bypasses.

E. Transport Equipment

1. Trucks

Since the beginning of the Rolling Thunder program, the North Vietnamese have lost about 5,200* trucks in North Vietnam. Estimates of yearly losses are given in the tabulation below:

Year	Effective Truck Losses*
1965	360
1966	1,900
1967	2,700
1968 (first quarter)	250

During 1967, 72,000 attack sorties were flown over Route Packages I, II, and III, resulting in the loss of about 2,400 trucks, a ratio of about 29.4 sorties for each truck destroyed (see Table 1). Truck losses in Route Packages I, II, and III were especially high in the second and third quarters of 1967, the periods of good weather. During the third quarter of 1967, when the best flying weather prevailed, only 15 sorties were flown for each truck destroyed, compared with 63 sorties in the fourth quarter.

** To arrive at an estimate of effective truck losses in both North Vietnam and Laos, pilot reports are first adjusted to eliminate double counting. Then a deflation factor is applied to adjust for inaccuracies in the data and for the North Vietnamese ability to repair and rebuild trucks. Inaccuracies are caused by high aircraft speeds; poor visibility resulting from weather, smoke, and dust after attacks; night operations; and intense AAA fire. The formula for computing effective losses agreed to by CIA and DIA is as follows: 75 percent of those trucks reported destroyed and 25 percent of those reported damaged are considered to be effective losses and are deducted from the inventory.*

Trucks have been much more lucrative targets in the southern route packages than in Route Packages IV, V, and VI. In the third quarter of 1967, more than 11,000 sorties were flown over the northern route packages, but only 60 trucks were destroyed. In comparison, 20,000 sorties in Route Packages I, II, and III destroyed 1,300 trucks during the same period.

Despite these large losses, there are no apparent shortages of motor trucks in the area, primarily because of continued large imports through Haiphong and by rail through China. Truck activity has continued at a high level, and road-watch teams situated along the major infiltration routes in Laos have noted steadily increasing truck traffic from North Vietnam into Laos over the past year. North Vietnam has increased its truck inventory from the pre-bombing level of 9,000 vehicles to more than 11,000 vehicles at present.

Increased truck losses from escalated attacks would have little effect on truck inventories. If the number of sorties against Route Packages I, II, and III increases by 25 percent in 1968 and the ratio of sorties to destroyed trucks remains the same, then about 3,100 trucks could be expected to be destroyed annually in the three southern route packages. However, North Vietnam's Communist allies have in the past quickly provided trucks to make good such losses. About 4,700 trucks were imported during 1967, and North Vietnam received about 900 trucks by rail from the Soviet Union in December 1967, only two months after a request made in October 1967.

2. Watercraft

About 6,700 watercraft have been destroyed during the Rolling Thunder program. The following tabulation gives total number of watercraft estimated to be destroyed and damaged by year as reported by pilots:

Year	Watercraft Destroyed/Damaged
1965	1,200
1966	9,250
1967	11,600
1968 (first quarter)	800

In 1967, destruction and damage to watercraft was greatest in Route Package III, which has a more developed inland waterway system than the other two route packages south of Thanh Hoa. The reported destruction of watercraft in each route package by quarter is given in Table 2.

The impact of past and future watercraft losses is slight. There is no evidence that the transport system has been limited by a shortage of watercraft. If the number of sorties against Route Packages I, II, and III increases by 25 percent in 1968 and the ratio of sorties to destroyed or damaged watercraft remains the same, about 9,500 watercraft will be destroyed or damaged in 1968. This loss would be nominal compared with the estimated total North Vietnamese inventory of 30,000 small craft. These small craft can be replaced by local construction or by imports from China if necessary.

3. Railroad Equipment

Data on the destruction of railroad cars are not available by route package. However, on the entire Hanoi-Vinh line in 1967, pilots reported destroying 355 railcars and damaging 658. During the same period, a total of 6,988 sorties were flown against the rail line, of which an estimated 3,470 sorties were flown against that portion of the line in Route Packages I, II, and III. Against the entire Hanoi-Vinh line, 19.7 sorties were required for each railcar destroyed and 10.6 for each railcar damaged. If the bombing effort against railroads is increased by 25 percent, and assuming that the ratios of sorties per railcar destroyed or damaged were maintained under an increased level of

attack, about 400 cars would be destroyed and 800 damaged.

Despite this attrition, there are no apparent shortages of rail equipment in the area. Photography of Thanh Hoa continues to show large concentrations of rail equipment. While the reported figures of equipment destroyed and damaged on the Vinh line represent about 40 percent of country-wide losses, the total inventory of railcars in North Vietnam has actually increased since the bombing began. Counts of cars from high-level photography in 1967 reveal about 2,000 to 2,300 railcars in the country, compared with about 1,800 before the bombing. It is believed that imports from China have more than offset losses.

V. Countermeasures

A. Air Defense

An increase in air attacks against Route Packages I, II, and III probably would be countered by shifting some antiaircraft artillery and SAM firing battalions from Route Packages IV, V, and VI. The movement of equipment and related operating personnel could be accomplished within ten days. An air defense capability against a decreased level of attacks would still remain in the northern areas after the redeployment, because the regime would continue to regard the defense of Hanoi and Haiphong as a high priority.

An increase of 40 percent in attack sorties in the southern area might be countered by redeploying about 750 antiaircraft weapons to Route Packages I, II, and III. This level of redeployment could be accomplished by reducing the AAA inventory in Route Packages IV, V, and VI by 20, 40, and 10 percent, respectively. This equipment, weighing 4,000 tons, could be moved south in a week to ten days. The AAA order of battle in the three southern route packages averaged 1,885 weapons of 37-mm or larger during March-December 1967. The remaining AAA inventory in the north would still be formidable. The North Vietnamese might attempt to offset an AAA redeployment by increased imports to continue their present air defense order of battle in the north.

North Vietnam might redeploy perhaps five SAM firing battalions and one support battalion to Route Packages I, II, and III. This shift would about double the SAM order of battle in Route Packages I, II, and III, currently estimated at five to six firing battalions. The redeployed battalions, with equipment weighing 3,000 to 3,500 tons, could be moved south in three to four days and could be moved back to the north in the same length of time in case of a sudden increase in attacks against that area. However, the North Vietnamese probably would try to import equipment for an additional five firing battalions to bring the inventory in the north to the present level.

If they moved five units south, an additional 25 SAM sites probably would be constructed in Route Packages I, II, and III to augment the 19 sites that are currently capable of accepting SAM equipment.

B. Manpower

North Vietnam would probably counter the escalated attacks by moving additional manpower into Route Packages I, II, and III to maintain the logistic system and to man the additional AAA's and SAM's, but this manpower requirement would be small and would have little effect on the country as a whole.

The North Vietnamese would probably respond to the stepped-up bombing by transferring 15,000 full-time workers to repair damage to the lines of communication in the south. At present, there are an estimated 72,000 North Vietnamese civilian road construction workers, including 56,000 workers in Route Packages I, II, and III and 24,000 to 40,000 Chinese construction troops employed throughout the country. About 15,000 experienced workers could be transferred within a short period of time, bringing the permanent labor force in the area up to about 70,000 personnel. This number of workers would be adequate to repair damage and/or construct additional bypasses caused by the change in the bombing pattern. Additional part-time workers could readily be obtained from the indigenous population of 2.7 million.

Redeployment of air defense equipment probably would result in an increased requirement for about 16,000 personnel -- 15,000 for the antiaircraft artillery and less than 1,000 for the SAM's -- but it is likely that troops would accompany their equipment being deployed to the south. There would be a requirement for an equal number of trained personnel in the north if and when imported equipment became available to replace equipment moved to the south.

Table 1

Estimates of Effective Truck Losses in North Vietnam, 1967

25X1

25X1

	Quarterly 1967				
	First	Second	Third	Fourth	Total
Route Packages I, II, and III					
Losses	195	684	1,343	220	2,442
Sorties	15,426	22,182	20,216	13,961	71,785
Sorties per loss	79.1	32.4	15.1	63.5	29.4
Route Packages IV, V, and VI					
Losses	39	65	61	77	242
Sorties	5,126	9,543	11,363	8,414	34,446
Sorties per loss	131.4	146.8	186.3	109.3	142.3

Table 2

Estimates of Watercraft Destroyed and Damaged
and Sorties Flown by Route Package, 1967

25X1 25X1

		Quarters				
		First	Second	Third	Fourth	Total
Route Package						
I	Destroyed/damaged	319	975	867	467	2,628
	Sorties	11,334	12,919	15,032	11,324	50,609
	Sorties per destroyed/damaged	35.5	13.3	17.3	24.2	19.3
II	Destroyed/damaged	261	680	576	177	1,694
	Sorties	1,588	3,987	2,554	1,134	9,263
	Sorties per destroyed/damaged	6.1	5.9	4.4	6.4	5.5
III	Destroyed/damaged	410	1,534	782	553	3,279
	Sorties	2,504	5,276	2,630	1,503	11,913
	Sorties per destroyed/damaged	6.1	3.4	3.4	2.7	3.6
IV	Destroyed/damaged	442	864	765	1,049	3,120
	Sorties	2,726	3,144	2,610	2,298	10,778
	Sorties per destroyed/damaged	6.1	3.6	3.4	2.2	3.5
V	Destroyed/damaged	1	20	6	2	29
	Sorties	720	1,201	939	844	3,704
	Sorties per destroyed/damaged	720.0	60.0	156.5	422.0	127.7
VI	Destroyed	122	188	206	361	877
	Sorties	1,680	5,198	7,820	5,272	19,970
	Sorties per destroyed/damaged	13.8	27.6	38.0	14.6	22.8

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